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163

INDIAN JOURNAL OF POWER & RIVER VALLEY DEVELOPMENT

VOL. VI. NO. 7 JUNE 1956 RUPEES TWO

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MAITHON DAM, DVC, JUNE '56

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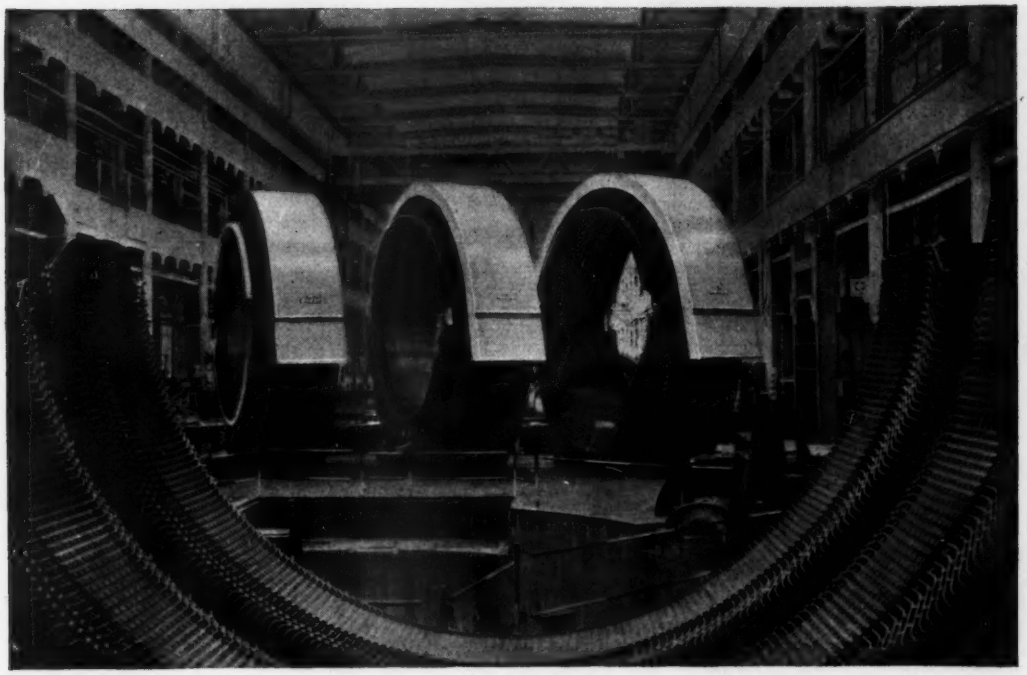

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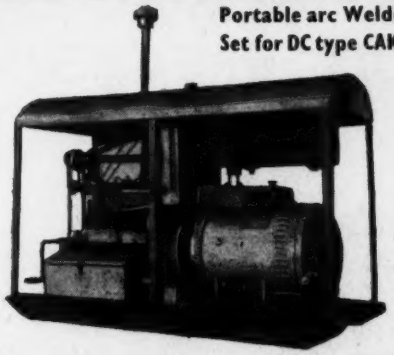
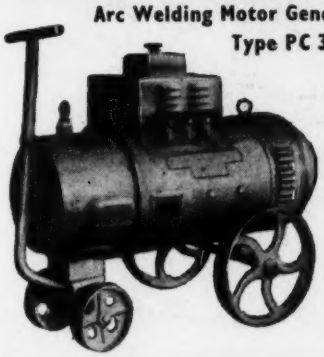
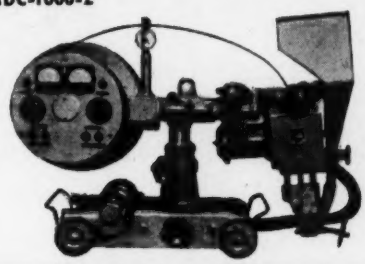
Portable arc Welding Set for DC type CAK-2



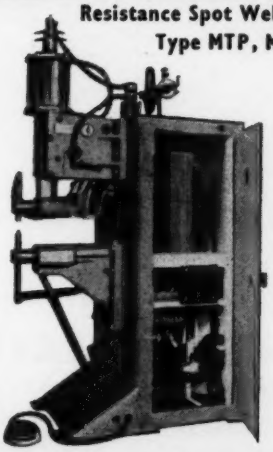
Arc Welding Motor Generators. Type PC 300-500



Portable Automatic Welding Unit Type ADC-1000-2

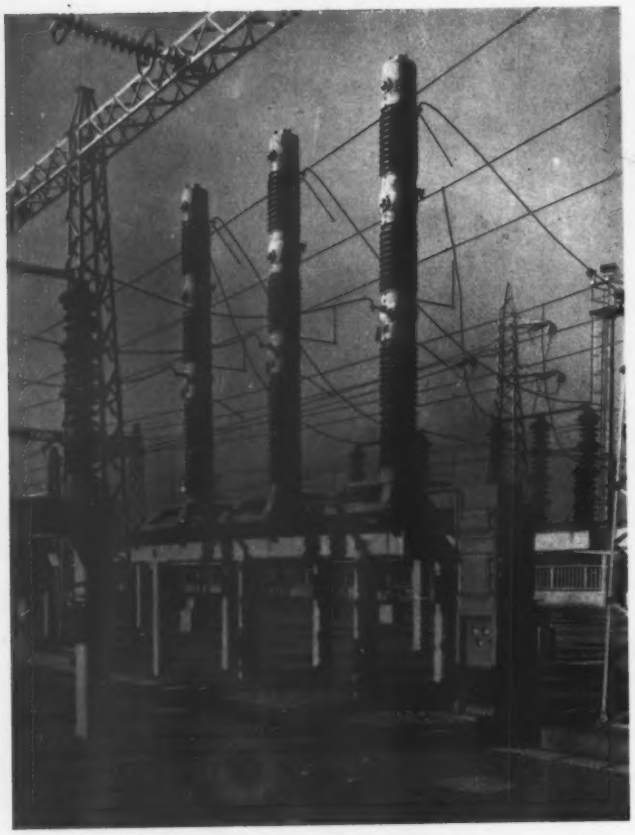


Resistance Spot Welder Type MTP, MTM



N-U.19

CIRCUIT BREAKERS



Type PO/350 N circuit breaker, suitable for 150 kV, 2200 MVA breaking capacity, installed at the Treviglio Substation of the State Italian Railways along the line from Milan to Venice.

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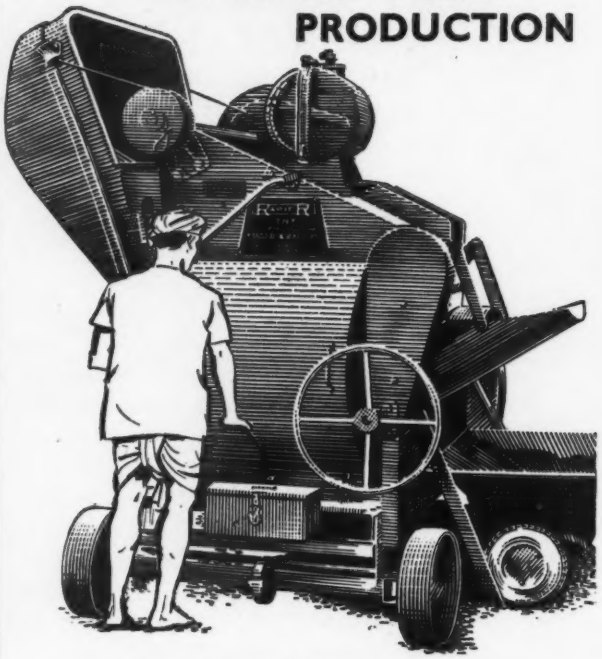

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PR/1

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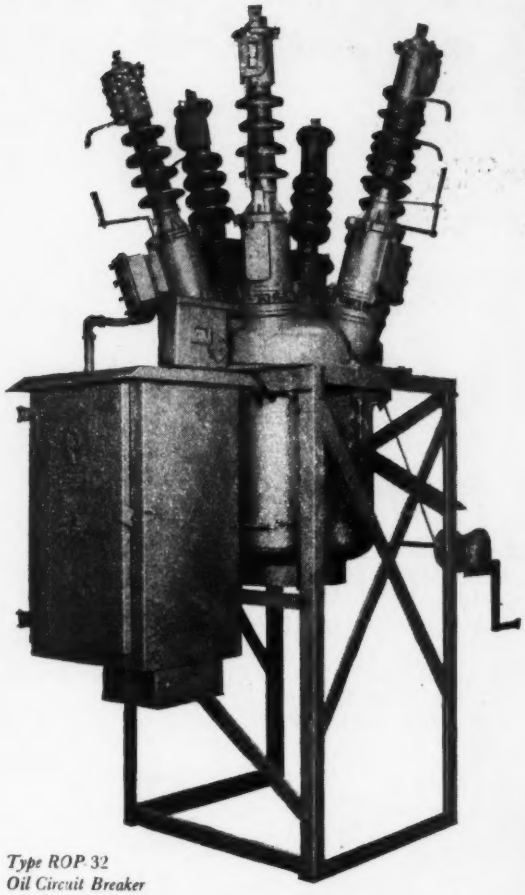


Type ROP 32
Oil Circuit Breaker

When the dam is built and the major constructional work completed the task of installing the electrical plant and the equipment must be undertaken.

Ferguson Pailin have supplied switchgear for indoor and outdoor stations, including major hydro-electric schemes the world over. 'F. P.' is synonymous with first-class design, manufacture and performance of this essential equipment, ranging from extra high voltage switchgear for main grid supply systems down to low voltage switchgear for industrial purposes.

Two examples of 'Ferguson Pailin' switchgear, for varying duties, are illustrated here. They are :—

ROP 32 OIL CIRCUIT-BREAKER

Wherever 22 kV or 33 kV outdoor oil circuit-breakers for breaking capacities up to 750 MVA are required the merits of the 'ROP 32' breaker should be considered.

The design of this breaker provides for the optimum protection against adverse working conditions peculiar to countries in various parts of the world as well as maximum resistance to the effects of fluctuating temperatures and humidity.

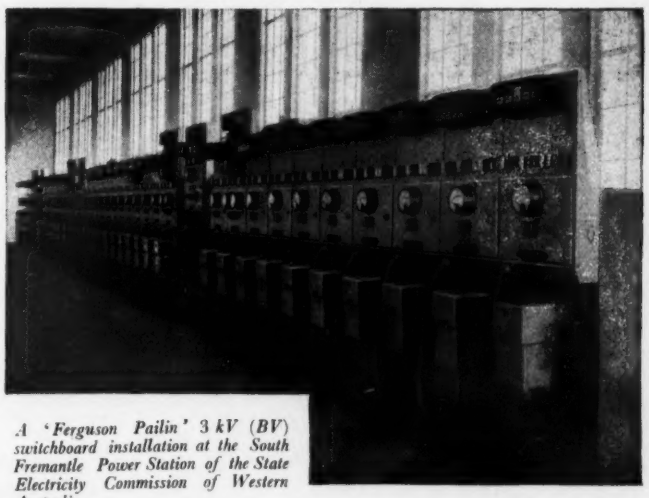
The versatility of the 'ROP 32' makes it remarkably adaptable to local requirements. Complete dependability and reliability make it a natural choice for incorporation into any scheme involving the transmission of power at 22 kV or 33 kV.

The circuit breaker tank is of cylindrical shape and all three phases are brought into one tank, permitting the use of smaller framework thereby achieving compactness.

'BV' SWITCHGEAR

'Ferguson Pailin' Type BV switchgear is of the completely enclosed metalclad type. It is constructed on the unit principle and can readily be extended by units of similar rating, or by metalclad oil switches.

Vertical isolation of the breaker ensures minimum space requirements of the unit, whilst adequate interlocks safeguard against mal-operation.



A 'Ferguson Pailin' 3 kV (BV) switchboard installation at the South Fremantle Power Station of the State Electricity Commission of Western Australia.

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The DW20—a four wheeled rubber-tyred tractor with 300 h. p. engine 10 forward speeds up to 32.1 m.p.h. for use with No. 456 scraper, capacity 25 cubic yards and other matched units. A smaller unit is the DW15 with 186 h. p. engine.

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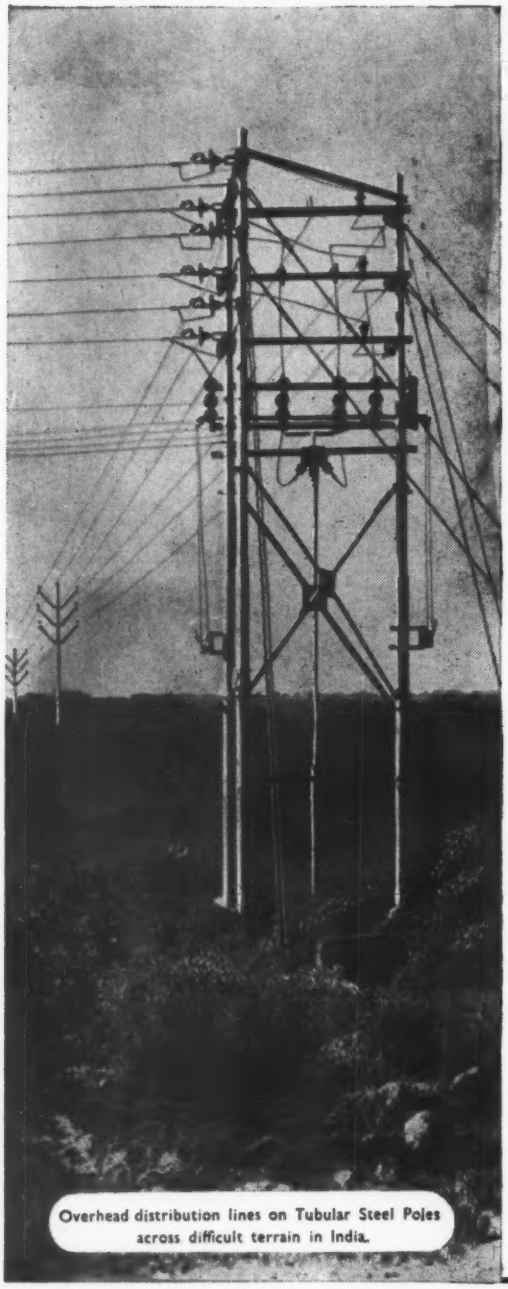

Overhead distribution lines on Tubular Steel Poles across difficult terrain in India.

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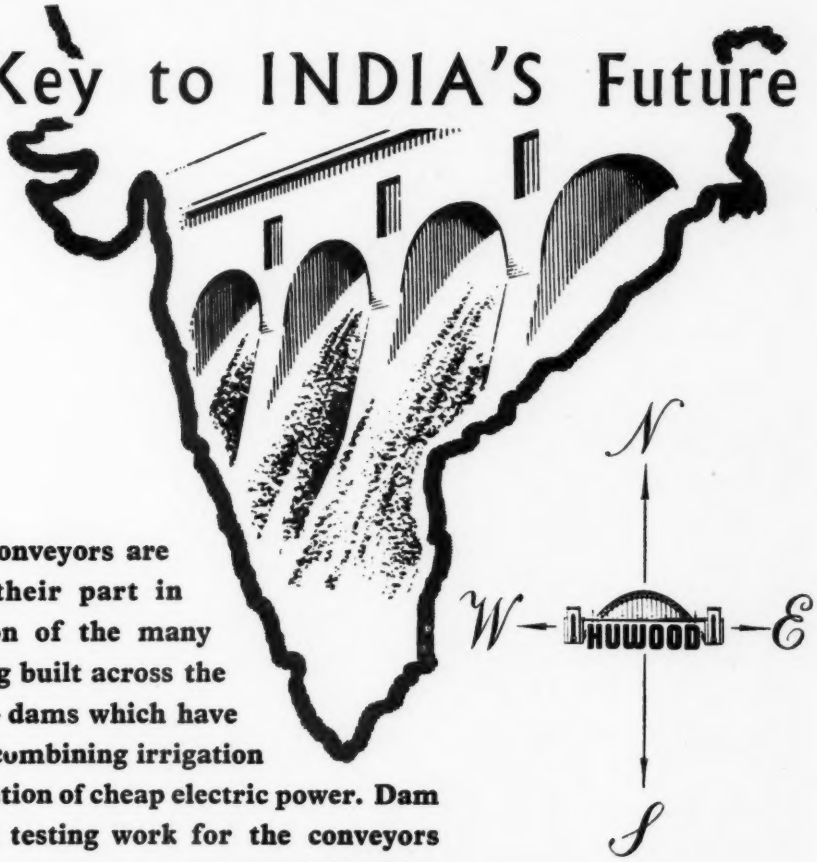
WATER...

...Key to INDIA'S Future



Huwood Conveyors are playing their part in the construction of the many dams now being built across the Indian rivers — dams which have the purpose of combining irrigation with the production of cheap electric power. Dam construction is testing work for the conveyors employed .. contractors must be sure of obtaining equipment which is both reliable and exactly adapted to their needs.

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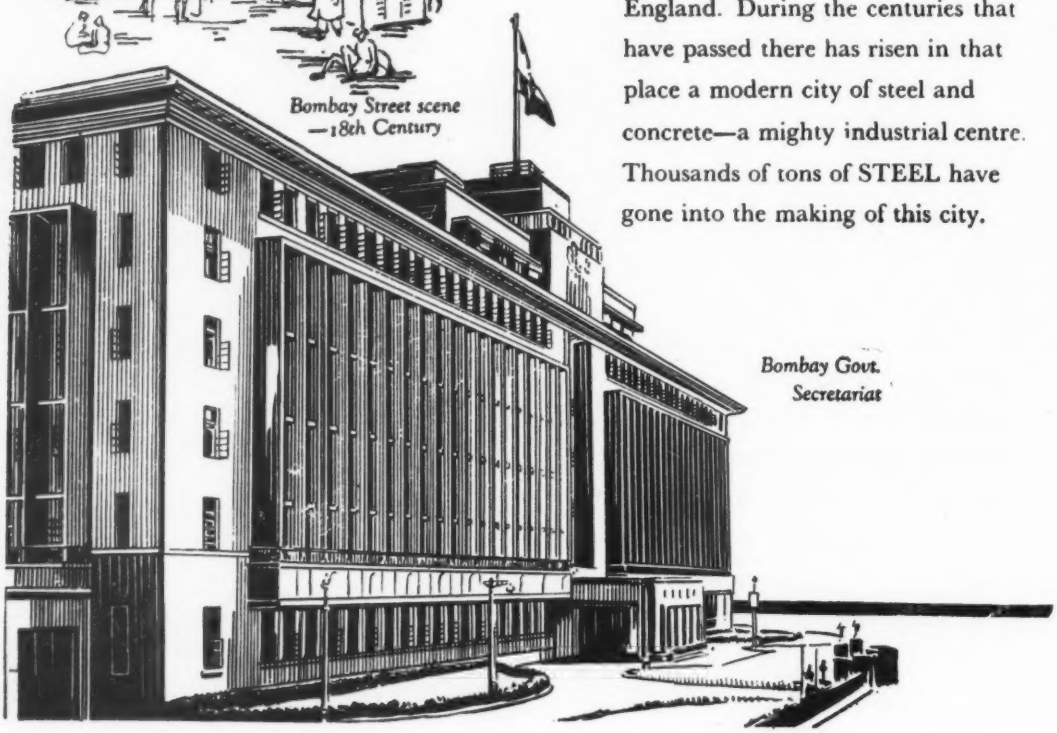
" Where now the city stands,
there was once naught but the city's site." OVID

Bombay

February 18, 1665. Only a small island of mud-flats and fishing villages, was what Humphry Cooke took over from the Portugese, as part of the marriage portion of the Infanta Catherine of Portugal for her husband, King Charles II of England. During the centuries that have passed there has risen in that place a modern city of steel and concrete—a mighty industrial centre. Thousands of tons of STEEL have gone into the making of this city.

Bombay Street scene —18th Century



Bombay Govt. Secretariat

Steel For Progress

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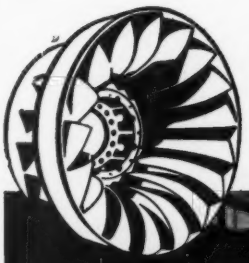
THE INDIAN IRON & STEEL CO. LTD. 12 MISSION ROW, CALCUTTA



IN CANADA AND NEW ZEALAND...
IN BOLIVIA AND BRAZIL...

Sixteen-foot diameter, 120,000 h.p. Francis runner on 42/52 foot boring mill (from rear). The addition of this boring mill in a new shop extension has increased by about 50% the Dominion Engineering Works capacity to handle large hydraulic turbine contracts.

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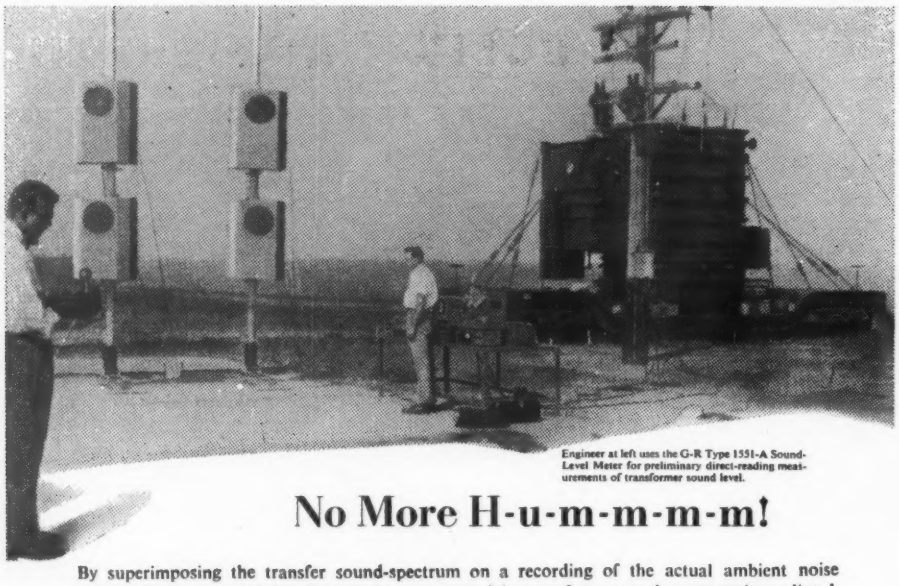

Engineer at left uses the G-R Type 1551-A Sound-Level Meter for preliminary direct-reading measurements of transformer sound level.

No More H-u-m-m-m-m!

By superimposing the transfer sound-spectrum on a recording of the actual ambient noise existing at the proposed site, the complete response of the transformer can be accurately predicted. Engineers faced with the problem of hum from power transformers in populated areas rely heavily on G-R Sound-measuring and Analyzing equipment. These instruments, of advanced design and highest reliability, are portable, battery operated, and completely self-contained for simple operation in practically any location. They include :

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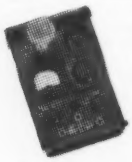
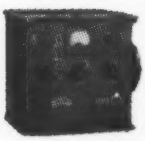


Type 1551-A Sound-Level Meter

. . . basic sound-measuring, tool for reading the sound-pressure level at its microphone in terms of the standard A.S.A. reference level.

Type 760-B Sound-Analyzer

. . . for narrow-band measurements of pitched sounds . . . best suited to measuring noise emitted by rotating, reciprocating or other cyclic mechanisms where prevalent frequency components are harmonically related to motor speed or other characteristic.



Type 1550-A Octave-Band Noise Analyzer

. . . for rapid, convenient broad-band analysis of "unpitched" sounds where the noise energy is widely distributed over the audio spectrum and is usually caused by shock excitation, impact or turbulence.

Type 1555-A Sound-Survey Meter

. . low-cost, pocket-size sound-level meter for preliminary investigations prior to detailed study and analysis with above equipment.

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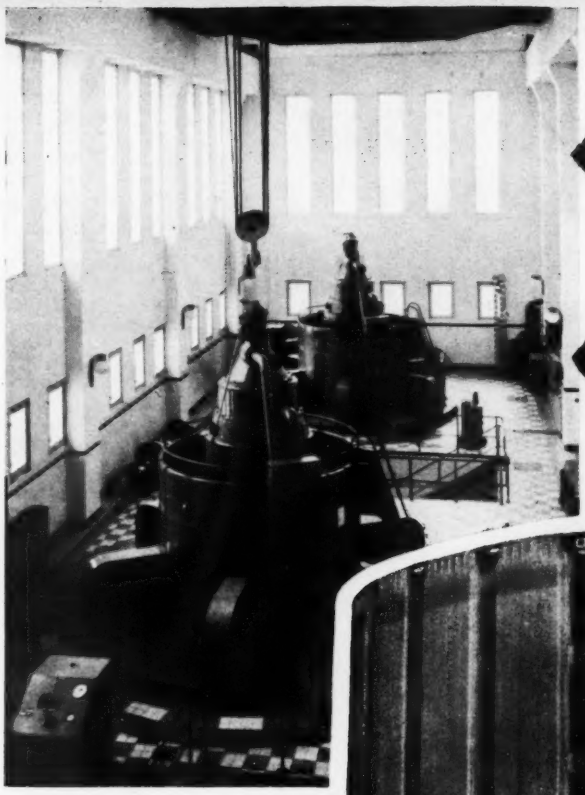

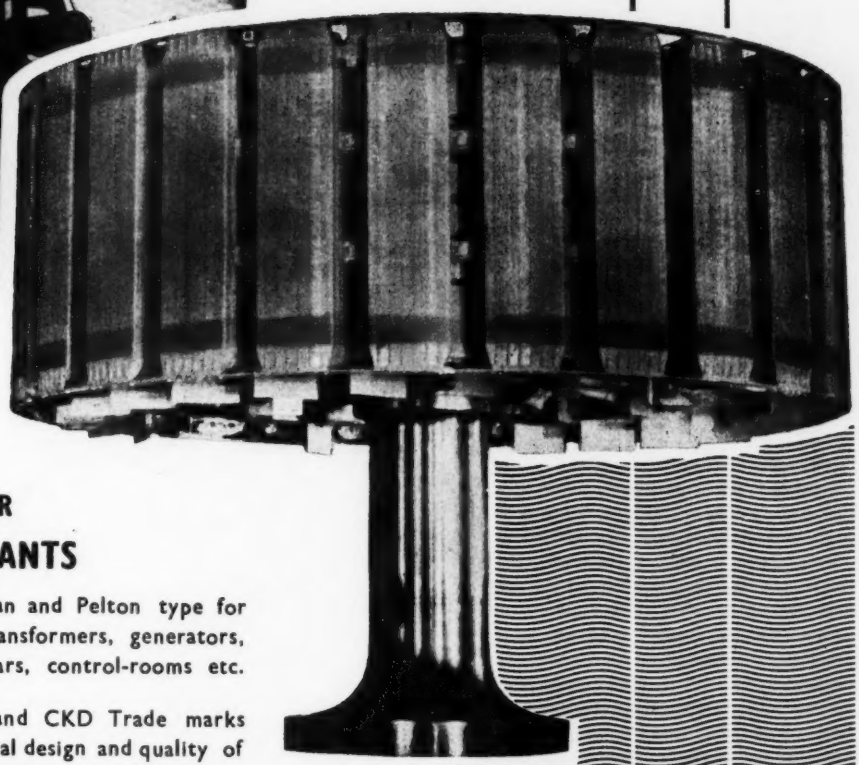

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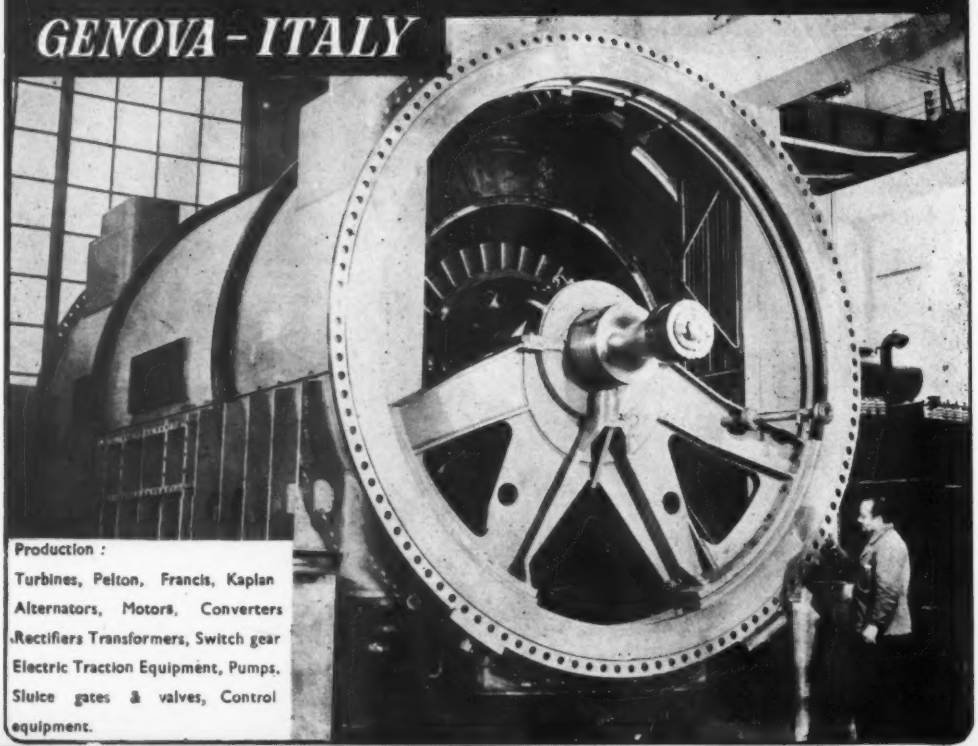

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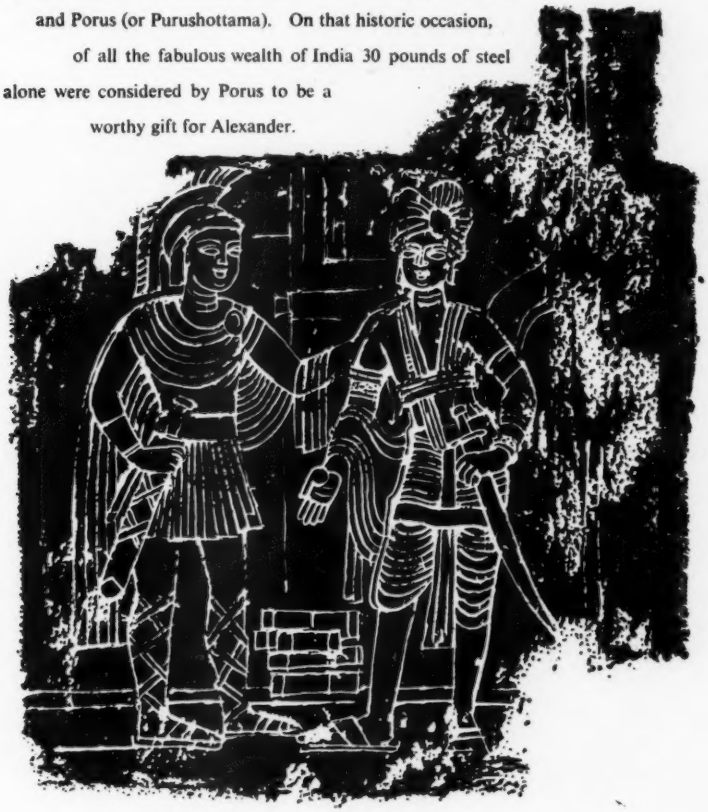

That was 2,300 years ago when India was already famous as the home of quality steel. Today, once again, steel is very much to the fore in the nation's thinking. India's steel-making capacity is being rapidly enlarged to provide a sure and solid basis for the country's industrial advancement.

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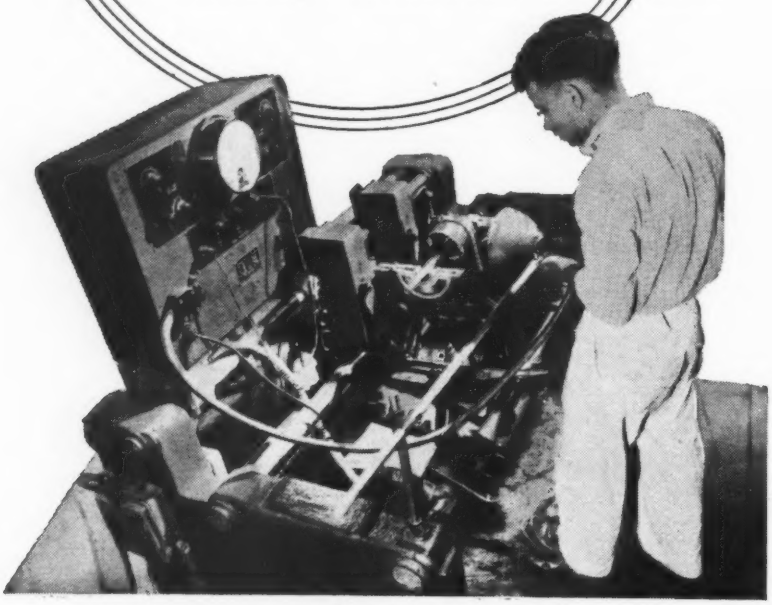

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working in sand, silt and slush have

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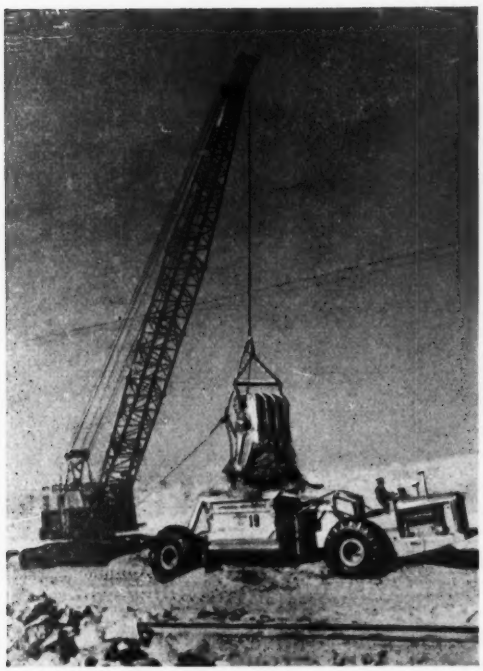

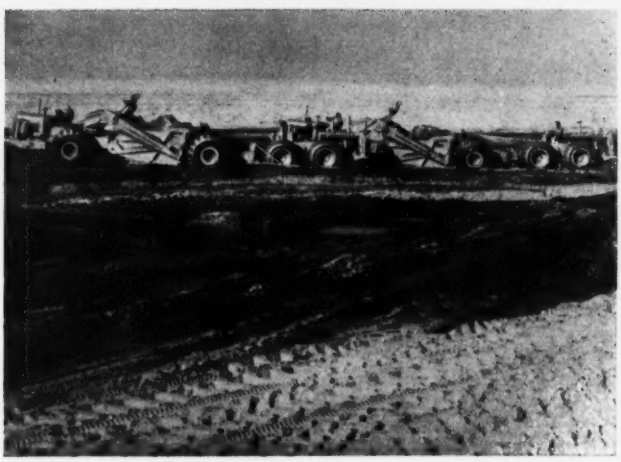

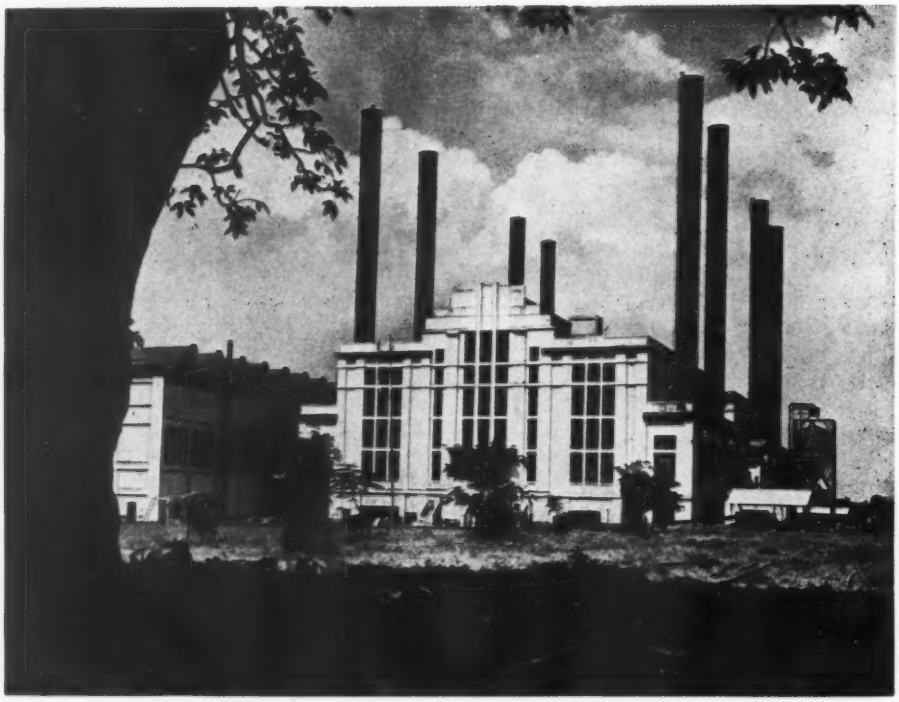

Front view of Mulajore Generating Station, Calcutta.

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CONTENTS

BETTERMENT LEVY : PAYMENT IN LAND	*C. S. Parthasarathy*	1
INTERNATIONAL ATOMIC ENERGY AGENCY		2
KOTLA POWER HOUSE	*T. S. Sodhi*	3
PLANNING INDIA'S IRRIGATION DEVELOPMENT		6
FLOOD FREQUENCIES IN MAJOR RIVERS OF ORISSA	*B. N. Sinha*	7
"MUST HAVE COMPLETE INVESTIGATIONS AND COMPREHENSIVE SCHEMES"	*Gulzari Lal Nanda*	11
DEVELOPMENTS IN ELECTRICAL ENGINEERING	*Frank Clawes*	13
MUSINGS OF AN INDIAN ENGINEER IN U.S.A		16
ROORKEE REFRESHER COURSE LECTURES		17
INDO-PAKISTAN TALKS ON INDUS BASIN WATERS		19
BOOK REVIEW		20
RIVERS AND POLITICS	*Editorial*	21
NOTES AND NEWS		23

In the coming issue :

The Floods of 1956 *by* G. L. Nanda, Minister for Irrigation and Power ; Planning a new Industrial Culture *by* Dr. Arthur E. Morgan ; Madras Plant Extension Stage III *by* V. P. Appadurai, Chief Engineer for Electricity, Madras ; Soil Conservation in Damodar Valley *by* B. P. Sinha ; Progress of Irrigation and Power in Pakistan—A Report ; Manual Labour versus Machinery - Report *by* C. P. and M. Committee, Govt. of India, Atomic Energy Development in India—A Report.

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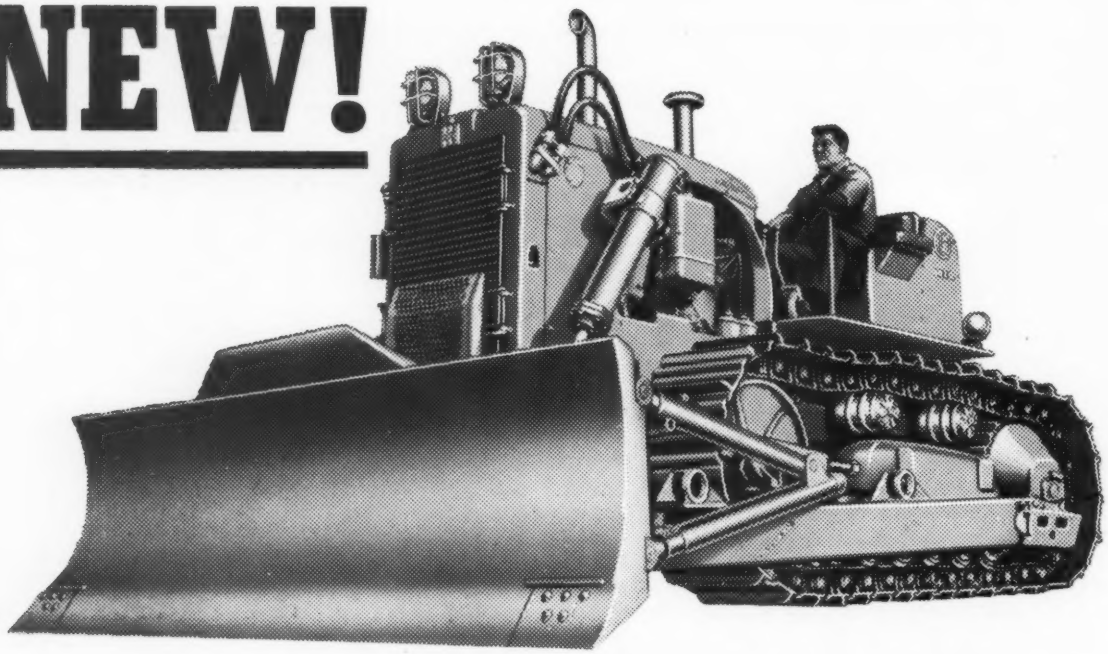

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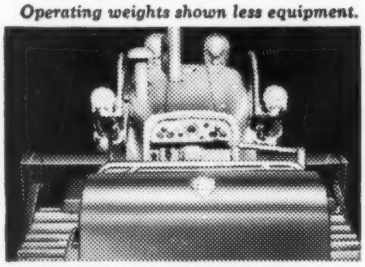

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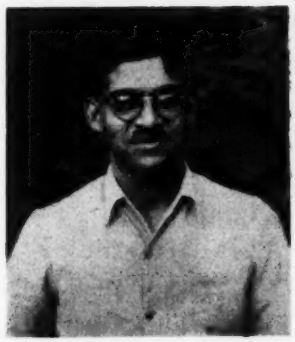
Betterment Levy: Payment in Land

By

C. S. PARTHASARATHY, B.E. (Hons), A.M.I.E.
Assistant Chief, Natural Resources, Planning Commission



AUTHOR

In this paper, it is proposed to discuss briefly the particular aspect of payment of betterment levy in the shape of land. In the report on the First Five Year Plan, it has been recommended that, in regard to the manner of recovery of the betterment levy which is capital tax aiming at Government obtaining from the land owner a share in the unearned increase in land value as a result of irrigation schemes, the betterment charges may be recovered in the shape of land by permitting the land owner to surrender to Government sufficient land in lieu of cash payment. Where there are large holdings, this would be preferable to recovery in cash. It would also be useful, under certain special circumstances, for the Government to take power to make the recovery in this manner, instead of leaving the option of such payment to the land-owner or beneficiary.

The underlying idea in advocating this mode of payment is that, by this means, the State will be able to obtain lands needed for :

(*i*) settling persons whose lands are submerged by reservoirs or are acquired for other purposes connected with projects,
(*ii*) settlement of displaced persons,
(*iii*) effecting improvements in the agricultural economy of the villages under the project by consolidation of holdings, making uneconomic holdings economic, assignment of lands to landless labourers etc.

There is a feeling in certain quarters that a provision vesting the Government with powers to make the land owner or the beneficiary pay the fees in the shape of land, under certain special circumstances, might attract Article 31 of the Constitution of India, which runs as under :—

"31(1) No person shall be deprived of his property save by authority of law.
(2) No property, movable or immovable, including any interest in, or in any company owning, any commercial or industrial undertaking, shall be taken possession of or acquired for public purposes under any law authorising the taking of such possession or or such acquisition, unless the law provides for compensation for the property taken possession of or acquired and either fixes the amount of compensation, or specifies the principle on which, and the manner in which, the compensation is to be determined and given.
(3) No such law as is referred in to clause (2) made by the Legislature of a State shall have effect unless such law, having been served for the consideration of the President, has received his assent."

According to this view, it is feared that "compulsory surrender of land towards payment of betterment fees would amount to expropriation, and that legislation providing for such a surrender would be unconstitutional". It will, however, be seen from the foregoing extract of Clause 31(2) that compensation would be given in such cases. The other view is that the Government can take the power to recover the levy in any form it chooses depending upon circumstances, which means that the Government, and not the land owner, may choose whether the levy is to be paid in cash or in the form of land.

"Compulsory surrender of land" may amount to State acquisition and would appear to fall under Article 31 of the Constitution but State acquisition may not amount to "expropriation" i.e. acquisition without payment of equitable compensation, since the compensation may be looked upon as the amount of the betterment fees which would otherwise be payable by the owner. Payment need not necessarily mean payment in cash. It may be effected by 'adjustment'. On the one hand, the land owner owes to Government the amount of betterment charges and, on the other, the Government may owe to the land-owner compensation for the land compulsorily acquired by it. The two amounts being equal may, perhaps, be adjusted against each other and, in this way, compensation for the land acquired by Government may be deemed to have been paid off. It is true that there may be cases in which Government, in exercise of its power, may choose to take the payment in cash, and others, under certain special circumstances, in which it may decide to take payment in the shape of land of acquisition value. This may not, however, amount to "discrimination", since the principle on which this power may be exercised could be mentioned in the law and where that is done, it would amount to "reasonable classification". This may particularly apply in respect of holdings above certain size without discrimination between individuals coming under the

general category specified in the law. It would also appear useful to include in the law the full details for the valuation of the land.

A study of the State Acts and Bills for betterment levy brings out the fact that legislation for betterment levy has already been passed in eleven States. Six of them, namely, Andhra, Bombay, Punjab, Hyderabad, Pepsu and Rajasthan have made suitable provision in their Acts to enable the land holder to pay the betterment fees in the shape of land. The remaining five States viz., Assam, Madras, Orissa, Mysore and Himachal Pradesh have made no such provision in their Acts. Bills have also been prepared in six other States. Of these, Madhya Bharat and Saurashtra have also made such provision in their Bills. The others, namely, Bihar, Madhya Pradesh, West Bengal and Travancore-Cochin have not included this provision in their Bills. Where provision has been made for payment in the shape of land, the option to do so has been left to the land owner or the beneficiary concerned. In other words, the law provides that the landowner may, at his option, pay the betterment levy either in the form of cash or by way of surrender of land of equivalent value. It appears that none of the States concerned has armed itself with powers to have the option of making a land-owner or beneficiary surrender land in lieu of betterment fees, under certain special circumstances. There does not, however, appear any reason why this should not be done. Of course, there may be some regions where the land holdings are already very small, and the payment of levy in the shape of land may, perhaps, be out of question.

The author's grateful tanks are due to Shri Yadava Mohan, Chief (Natural Resources), Planning Commission for the most valuable advice and guidance in the preparation of this paper. It should be made clear that whatever views or opinion have been expressed in this paper are the author's own and not of the organisation in which he serves.

International Atomic Energy Agency

A blueprint for the first worldwide agency for the peaceful uses of atomic energy was made public at United Nations Headquarters in New York.

Also released was a study by Secretary-General Dag Hammarskjold and his atomic advisory committee on the relationship between the new agency and the UN.

The draft statute of the International Atomic Energy Agency was unanimously agreed upon by a 12 nation negotiating group which has been meeting in Washington since the end of February. It has been circulated to the Member Governments of the United Nations and its specialized agencies which will discuss it at a conference tentatively scheduled to open on 24 September at UN Headquarters.

Participating in the Washington negotiations were: Australia, Belgium, Brazil, Canada, Czechoslovakia, France, India, Portugal, South Africa, the Soviet Union, the United Kingdom and the United States.

Main Points

Among its main points, the 23-Article draft statute provides that the Agency shall have a 23-nation Board of Governors, representing all major regions of the world, and shall function both as a storehouse for atomic materials and, if requested as "an intermediary" for the supply of services or materials between its members.

It would thus act as both "banker" and "broker," a point which figured largely in the UN General Assembly debates on the subject during its last two sessions.

The statute also allows the Agency to send inspectors to the territory of any member state requesting its assistance on a project. It stipulates, however, that they shall be designated after consultation with the country concerned.

On the question of the Agency's relationship with the UN—another major point at issue in the General Assembly—both the statute and the Secretary-General's study propose that the Agency shall submit reports to the General Assembly, to the Economic and Social Council and other UN organs matters within their competence, and to the Security Council "when appropriate".

Where the Security Council is concerned, the statute makes the further provision that if, in connection with the Agency's activities, questions arise which fall within the Council's competence, the Agency should notify the Council "as the organ bearing the main responsibility for the maintenance of international peace and security." It also provides for possible measures by the Agency, including the curtailment or suspension of assistance to an offending state, and its suspension from the rights of membership in the Agency.

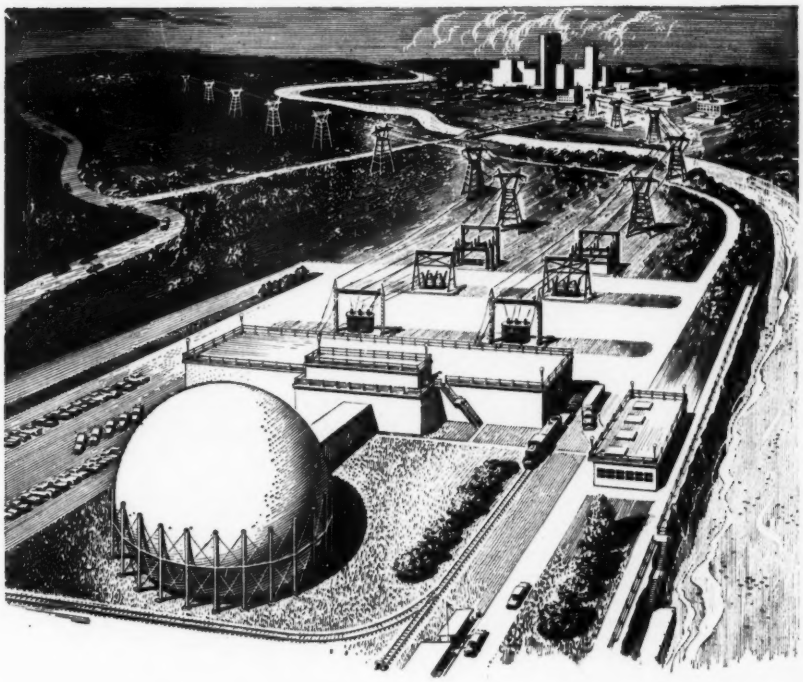
Relationship to UN

The Secretary-General's study of the relationship between the Agency and the UN was prepared at the request of the General Assembly. It provides that the UN shall recognize the Agency as "under the aegis of the United Nations", the phrase used by United States President Dwight D. Eisenhower when he first proposed the establishment of the new body in an address to the Assembly on 8 December 1953.

In the Assembly's debates in the two subsequent years, there was considerable discussion as to whether the new Agency should bear the same relationship to the UN as the already established specialised agencies, or whether it should have a close link.

A Difference

Under the study's recommendations, a major difference between the Atomic Energy Agency and the specialized agencies would be that the new body would report directly to the Assembly and also to the Security Council when necessary—instead of to the Economic and Social Council only, as the specialized agencies do.



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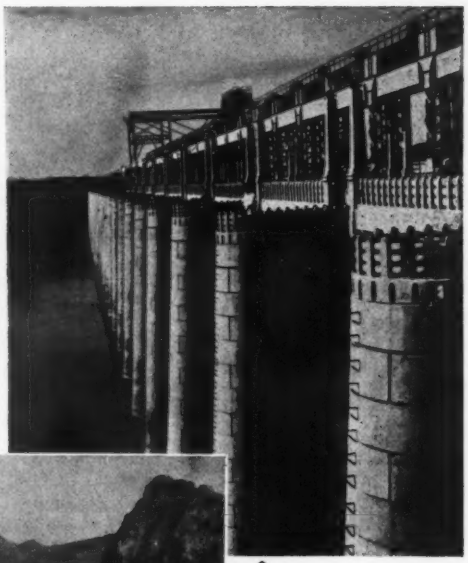
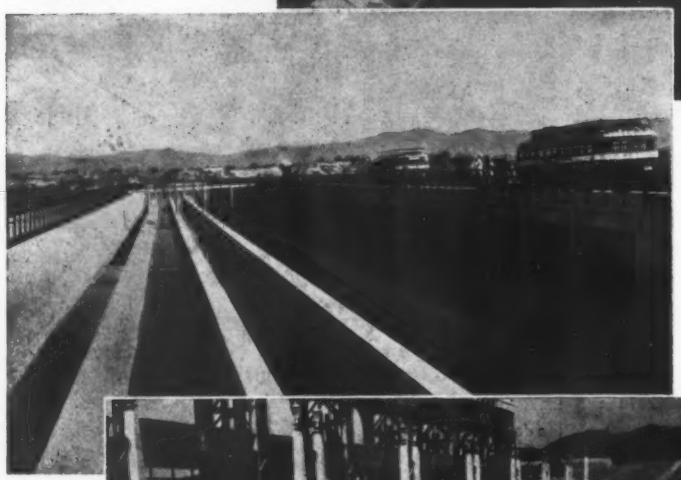


▲ Nangal Barrage. Down-stream view from the left bank.

Sirsa Aqueduct View showing Nangal Hydel Channel crossing the Sirsa River. Mark the R. C. inverted T-beams, road, and foot bridges. ▼

▲ A view of the concrete-lined Nangal Hydel Channel upstream of Lohand Syphon.



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◀ Nangal Hydel channel Head Works. View from down stream.

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Kotla Power House

T. S. SODHI

AUTHOR

The Kotla Power House was inaugurated by Sri Govind Ballabh Pant, Home Minister, Government of India, on June 9, 1956. The following is a contribution describing the Power House.

The first step towards the construction of a Power house under the Bhakra-Nangal Power Project was accomplished in January, 1955, when Ganguwal Power House was commissioned into service. The completion of Kotla Power House now marks the second step forward.

Nestling in the picturesque landscape on the foot of the Shiwalik Hills, Kotla Power House lies near the famous Naina Devi Mandir and the sacred Shri Anandpur Sahib Gurdwara. The Power Station situated about midway between Rupar and Nangal, is on the metalled road running between these stations. It is also accessible by rail with railheads at Anandpur and Kiratpur.

There are three main stages in the generation of hydro-electricity i.e. the creation of potential energy by a water fall, the conversion of this potential energy into mechanical energy through a turbine, and the conversion of mechanical energy into electrical energy through a generator.

At Kotla Power House the potential energy is derived by a water fall of 98 ft. The Nangal Hydel Channel, which takes its supply from River Sutlej, with its head-works at Nangal, after covering a distance of 17 miles, reaches Kotla to provide a fall. The canal has a carrying capacity of 12,500 cusecs of water. It is nedless to emphasize that the Nangal Hydel Channel is the biggest concrete-lined canal of its size and length in the world.

Forebay Regulator

Water, having reached Kotla, is regulated and controlled at the forebay regulator. It, then, passes into the penstocks and subsequently sets the turbines and generators into motion. There are three intakes at the forebay—one for each unit. The trash-racks serve as a screen, which stops any floating material like logs and twigs from finding their way into the penstocks and thus damaging the turbines. The water supply after passing through the screen is led into the penstocks through the radial gates. In order to work the radial gates for repairs or in case of their failure, an alternate arrangement of Stop-logs is provided. There is a mechanical hoisting arrangement for the rasing and lowering of the trash-racks and the the stop-logs. The main radial gates are both electrically and mechanically operated. On the east bank of the canal, just above the intakes, a spillway is provided to bypass the surplus water in the Nangal Hydel Channel. These spillway gates are operated electrically as also through a float switch mechanism. On the down-stream face of the power house, draft tube gates with hoisting mechanism are provided.

From the forebay, water enters the penstocks, which are steel pipes 150 ft. long with a diameter of 19′-3″. After the penstocks, water goes to the scroll casing and having passed through the wicket gates, it sets turbines, and consequently the generators, which are connected to the turbines with a shaft, into motion, and thus electricity is generated.

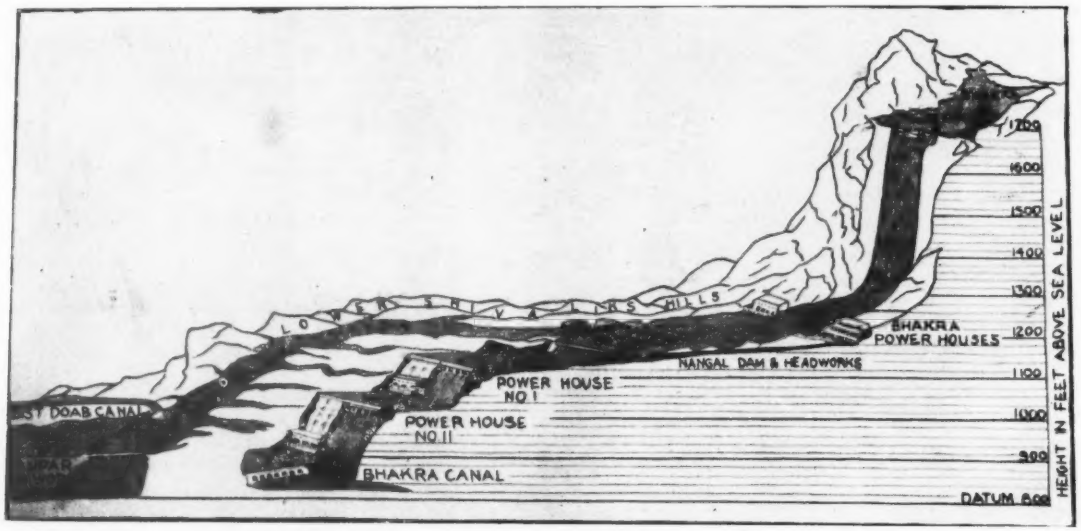
Two Units

In its essential details, Kotla Power Station has two units of 24,000 KW each with a provision for a third unit of the same size. The water wheel generators are coupled to adjustable blade propeller type Kaplan turbines with a rated capacity of 33,500 H.P. under a normal head of 98 ft. at a speed of 166-7 R.P.M.

The water wheel generators have a rated full load output of 27,500 KVA at 0.88 p.f. at 11,000 volts. The generated voltage is stepped up to 1,32,000 volts through two forced water cooled 27,500 KVA power transformers for transmission purposes. These are located in the switch-yard, very close to the power house building and overlooking the tail race. Most of the switching operations in the switchyard are done electrically from the control room, where indications in regard to the position of each switch and circuit breaker are also available.

The excavation for the main power house building was started 225 ft. below natural ground level and 91 ft. below the sub-soil water table to ensure stability of the foundations. The main building is 220 ft.×57 ft. out of which generator bays occupy 164′×57′. It is partially air-conditioned to effect better operation of the very expensive equipment installed therein. Supported on the super-structure has been erected a 200-ton crane for the installation of heavy equipment in the power house and subsequently for repairs and maintenance work.

T. S. Sodhi *is Superintending Engineer, Generation Circle, Bhakra-Nangal Project.*



Illustrative profile of the Bhakra Dam and Nangal Hydel Canal showing the drop in levels and the power houses.

Economy

The power house layout has been based with an eye on economy of space and yet generous allowances have been made here and there to allow for the movement and operation of heavy equipment at the time of power house construction or future repairs. The layout provides for units, bays housing the auxiliaries and control for each unit separately and a service bay at the switchyard end of the power house on the generator floor under the power house crane. This ensures that all the mechanical control and a portion of the electrical controls are situated as near to the unit proper as possible in order to economise on the length of leads, control cables and pipes. A cable gallery on the upstream side of the power house at turbine floor level provides a separate clear run of generator leads and electrical conduits without interfering with other power house functions. The essential auxiliary services like water piping, oil, compressed air equipment and carbon dioxide batteries are all centrally located in the power house to afford convenient access to these services. The advantage of this layout in the power house is that all major electrical equipment as well as all turbine, generator, switchgear and switchyard controls are located on the same generator floor level within operating range and sight of the operator.

Novel Features

The Kotla Power House incorporates all the novel features of a modern power house both in its building and layout and also in its generating machinery, auxiliary services and protective devices. A very outstanding feature of this power station lies in its its control and operation from the Ganguwal Power House, about six miles away, through special equipment and cables by supervisory means. This remote control system enables the staff at Ganguwal to run and operate the units installed at Kotla. It will aslo control the operation of the extra high-tension oil circuit breakers. The loading conditions of Kotla machines will also be indicated by meters on the control panels in the Ganguwal Power House. This will result in elimination of human error in carrying out complicated operations.

Another important feature is the installation of carrier communication system connecting up the various important grid sub-stations to the power house. This system is most necessary for the control operations and the continuity of supply to the various distribution centres.

The power generated from the Nangal power project is being transmitted to various load centres in the

Pt. Govind Vallabh Pant, Union Home Minister, going round the Kotla Power House. Beside him on the left is Prof. Sher Singh, Minister for Power & Irrigation, Punjab

A view of Kotla Power House under Construction

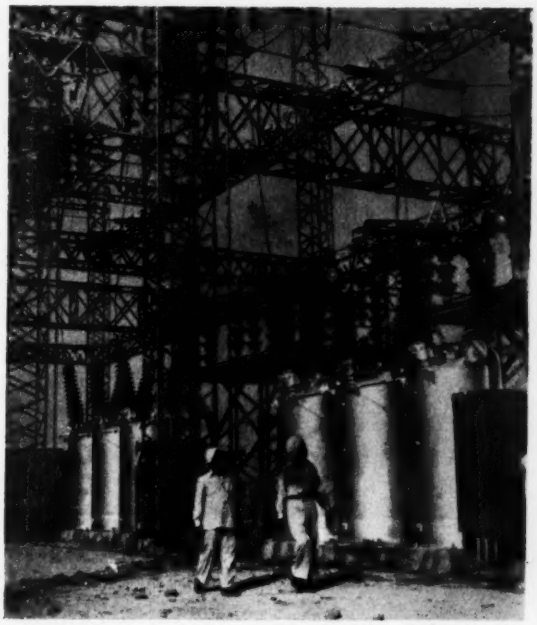
States of Punjab, PEPSU, Rajasthan, Himachal Pradesh and Delhi through a network of extra high tension transmission and distribution lines. Hundreds of grid sub-stations and distribution sub-stations have been installed to take the electric power to every took and corner of this area. Sufficient power will also be made available in this area for tube well which would increase food production of the country.

The Punjab State happens to be in that part of the country where coal for industry and domestic purposes has to be imported from far off states. Electricity is, therefore, to play a very important part in the development of industry, which is so vital to the well-being of the State, nay the entire country. Prior to January, 1955, there had been only one big hydro-electric plant at Jogindernagar, which catered to the needs of Punjab. This plant has an installed capacity of 48,000 KW. With the increasing demand of electric power from the general public and from the industrial concerns of the States of Punjab, PEPSU, Himachal Pradesh, Rajasthan and Delhi, it was felt that Jogindernagar power station was unable to meet the new requirements. It was, therefore, decided to build two power stations on the Nangal Hydel Channel—one at Ganguwal and the other at Kotla. A dam was constructed at Nangal and the water of river Sutlej diverted through the Nangal Hydel Channel to Ganguwal and Kotla Power Houses.

Ultimately the Bhakra-Nangal Power Project is going to have four power stations—two at Bhakra, one at Ganguwal and one at Kotla. The total installed capacity of all these plants is going to be 9,54,000 KW. with a primary power potential of 5,44,000 KW.

The demand of power from the States fed from Nangal Power Project is increasing at such a rapid rate that it has become necessary to instal two more units of 24,000 KW. each—one at Ganguwal and the other at Kotla. Side by side, five units, each of 90,000 KW. capacity, will be installed on the left bank of Sutlej and Bhakra. These units at Ganguwal, Kotla and Bhakra are expected to be brought into operation by 1959-60. Demand for more power will necessitate the installation of four more units of 90,000 KW. each on the right side of Bhakra Dam soon after.

Sub-station of the Power House at Kotla from where electricity will be supplied to the Punjab and contiguous areas.



Groundwater Survey completed

The Geological Survey of India in collaboration with the Central Ministry of Food and Agriculture has completed the first stage of the world's greatest groundwater exploration programme, to examine the groundwater resources of 16 areas covering a large part of India.

Exploratory drilling under the project has recently been completed in the Narbada Valley, Madhya Pradesh, where 35 boreholes with an average depth of 500 feet were drilled. The individual boreholes ranged in depth from 79 to 1,053 feet.

As a result of these studies in the Narbada Valley, a potential sustained groundwater yield of at least 10.5 million gallons per day or about 7,100 acre feet for an irrigation season of six months has been assured.

This assured supply which represents the combined discharge of a few key wells strategically located in areas found underlain, by prolific water-yielding strata, will, it is thought be increased many times as local authorities proceed with the development of groundwater from the source beds discovered during the survey.

Work on the programme began in January, 1955. The Exploratory Tubewells Organization of the Food and Agriculture Ministry has been entrusted with drilling and construction of test wells. The Geological Survey of India has been assigned the responsibility for delineating the areas to be explored, and for collection, analysis and interpretation of the data obtained from the bore-holes and from regional geological and hydrological surveys to be carried out. As part of its contribution to this programme the United States has provided groundwater geologists and engineers from the U.S. Geological Survey.

Planning India's Irrigation Development

When the Planning Commission started drawing an a Plan for irrigation development of the country, they were faced with the problem of lack of data. In the matter of selecting river valley projects for execution all the States were anxious to promote as many schemes as possible. In many cases investigations were not complete and hydrological and other data were unreliable. Some States did not have enough resources or personnel and had not carried out any investigations, and therefore, could not put forward any schemes for consideration.

It was under these circumstances, that the Planning Commission had to evolve a Five-Year Plan. Self-sufficiency was the main objective of all these schemes. A balanced regional development, though extremely desirable, was not quite possible. Thus the Planning Commission had to reconcile themselves to some sort of compromise and produce the best plan possible under the circumstances.

A proper assessment of India's irrigation potential is necessary to enable the Planning Commission to fix up priorities for the different schemes to be taken up in the Second Five-Year Plan.

The subject may be divided into two parts, viz. (1) Method of assessment of irrigation resources (2) Investigations and surveys.

Method of Assessment

This requires an analysis of available water with reference to rainfall, irrigation, intensity nature of soil, etc. The collection of data is a huge undertaking since the sources lie scattered in various documents and States and will require a long time. Water requirements of crops vary from region to region depending upon climate and soil conditions. Temperature, wind humidity etc. affect soil moisture conditions and are important factors in determining the crop pattern on areas under Irrigation. This information has, therefore, to be collected. Since many factors are involved, an accurate assessment of Irrigation potential cannot be worked out in a few years. An approximate assessment, will, however, help the planners in selecting the States or basins for irrigation development and fixing priorities of the proposed projects.

The assessment is done in the following stages :

For assessment of the overall water and land resources available for irrigation in various basins or regions, since the rainfall varies from year to year, a statistical analysis of the rainfall data for a number of years should be made. Where actual data for rainfall run-off is not available, use of a suitable formula should be made. There are two methods in use for computing the run-off from rainfall : the proportional method and the rational method.

The proportional method is the one which was adopted in the early nineties of the last century and expresses the run-off as a certain percentage of rainfall, the ratio depending on the magnitude of rainfall and catchment characteristics like shape, slope, vegetable cover, land-use, etc. This method is purely empirical and for any particular catchment area may give reasonably correct values of run-off in normal years, but there will be wide variations between actuals and calculated values in dry and wet years. The run-off to rainfall ratios vary with the rainfall, and from one catchment to the other for the same rainfall. Many authors have prepared charts and tables (e.g. Binny, Strange and Inglis) to be used for finding out run-off from rainfall for different types of catchments. These should be carefully used since values obtained will depend on the nature of catchment.

Rational Method

This method of determining the annual or seasonal run-off from the rainfall figures takes into account the principal factors which are responsible for a part of the rainfall being lost to run-off. These factors are evaporation and transpiration which are governed mainly by the main temperature. Sunshine, clouds, wind velocity and humidity have some effect, but these generally follow the temperature cycle and can, therefore, be covered by the temperature factor. The shape of the catchment, the slope and vegetable cover affect the seasonal distribution of run-off but not the aggregate run-off. The existence of glaciers can be a factor of considerable importance and needs special consideration.

Soil surveys should be conducted and land available for irrigation in the command of a project should be found out. These surveys will also be useful for determining the best use of water for growing money crops and improved crop yield.

The agricultural statistics collected by the Ministry of Food and Agriculture give areas irrigated year by year and the crops grown in various States. But the water utilised by the different regions is not available. For a few big projects such studies have been made, but since there are a number of small irrigation schemes, the data are not sufficient. Approximations have to be made for assessing the water used from the water requirements of crops in the areas already under irrigation.

Optimum Utilisation

The possibilities of using the balance of water and land to the optimum limit for irrigation are investigated with the help of Survey of India maps. The probable dam sites and the areas which may be brought under irrigation by canals from the proposed reservoirs are found out.

(*Continued on page* 22)

Flood Frequencies in Major Rivers of Orissa

By

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AUTHOR

The river Mahanadi has played her unquestioned role by sweeping over the flooded track of her delta from time immemorial. The Puri Sader Sub-division is worst hit by the floods and referring to this part it is said"...of the 32 years ending in 1866, 24 years were of floods so serious as to require remissions of revenue and during the last 25 years period there was only a single one in which remissions were not required." "The district of Cuttack is also visited by catastrophic floods and since 1830 the floods of a serious character have occurred for about 9 times within a period of 38 years (1830-68). In the year 1855 the highest flood occurred when it reached a level of 127.13 ft. and of 93.36[1] ft. at Lalbag and Naraj gauges respectively during which breaches occurred in 1363 places in the embankments and an area of 32 sq. miles was laid waste permanently".

The floods in other minor rivers of Orissa were and are neither so alarming in their devastation nor they are so very extensive in nature. The Subarnarekha, the eastern-most major river of Orissa, affects 4-12 miles from the river banks during the floods but the Haskura, a minor river often causes considerable damage. The Baitarani, the third important river, so far the question of flood is concerned, causes wide-spread havoc and turns the entire area from Dhamnara to Chandbali like a great sheet of water is a common scene. The floods of 1868 were the highest as during the other floods of 1896 both the Subarnarekna and Baitarani were in spate whereas the central Burhabalang and Saland were little affected. During 1920 this area was also hard hit from floods. The general flooded area is bounded by H.L.C. Range II and Range III and a line drawn through Albe, Aul on the west and Chandbali on the east. The north and south limits of the area is the Bhadrak-Chandbali road on the north and Patamunda canal on the south. Out of an area of 855 sq. miles, 590 sq. miles i.e., 69% are affected by floods of varied intensity.

Apart from all these sources a study of the reliable gauge readings of three recording stations at the head of the three deltas[2] reveals many salient factors.

The Mahanadi

The maximum gauge reading from 1868-1929 at Naraj and the co-relation of the average rainfall in inches per day (3 days period) in the Mahanadi catchment lead us to the following conclusions when they are graphically represented.

(*a*) Within a period of 62 years, 16 high floods[3], 23 floods of medium heights and 24 low floods have been experienced in the delta[4] (vide table No. 1) and thus the average probability of frequency of occurrences is 3.37 ; 2.69 ; 2.58 years in case of high, medium and floods of low intensity respectively Thus the frequency of occurrence is proportional to their intensity but the frequency of high floods has increased markedly from 1888 to 1927 with a short spell of a decade (1898-1907), whereas medium or low floods have not revealed any marked tendency, when they are considered on the ten-year intervals (Vide table No 2). In the year 1896 maximum flood level was reached at Naraj (91.95) on the 25th of July.

(*b*) So far as the time of occurrence of floods is concerned, the high floods start from the 21st June to end of August. The percentage of frequency is highest from 21st July to 7th August during which 37.50% of high flood has been experienced from 1862-1929. Besides this, from 21st Aug. to 30th Aug. is also another period of high concentration which accounts for 25.00% of the total occurrences[5] (vide Graph No. 1) Stray occurrences of floods of medium intensity from the 21st to the end of June and from 1st to 7th July take place whereas they regularly occur from 15th July to 30th Sept. With seasonal peaks from 21st July to 7th August when 30.42% of the total occurrences have been experienced. The second peak occurs from 21st Aug. to the end of the month. The medium type floods spread over the entire length of three months and 10 days (20th June—30th Sept). The floods of low intensity start from 20th June and continue to occur upto mid-September with the

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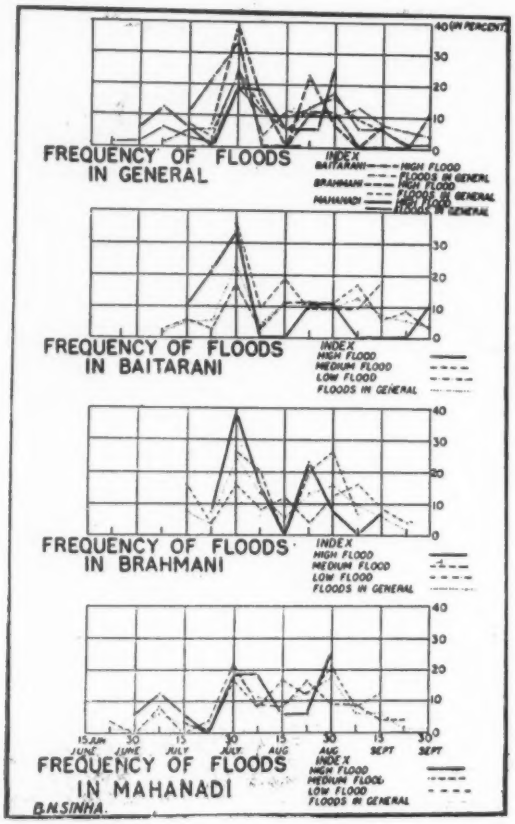
[1] No authentic record is available.

[2] Naraj at the apex of Mahanadi. Jenapur, at the apex of Brahmani. Akhuapada, at the apex of Baitarani.

[3] High floods: 1872, 1874, 1879, 1885, 1891, 1892, 1896, 1909, 1910, 1911, 1914, 1919, 192), 1925, 1926, & 1929.

[4] When the gauge reading is 90ft. or above it is called a high flood.
" " 87ft. " a medium flood.
" " below 87ft. it is low flood.

[5] All the floods have been graphically plotted according to their intensity and time of occurrences,



Graph No. 1.

maximum occurrence from 21st July to the end of August during which 75.07% of the total occurences are experienced. When the floods in general are considered, majority of them occur from 21st July to the end of August when 69.83% of the total floods are experienced with two individual peaks (21st-30th July ; 21st-30th Aug.).

(*c*) Almost all the types of floods have their peak times during 21st July to 7th Aug. and the second peak from 21st Aug. to end of the same month during which on an average 19.04% and 17.47% of the total occurrences are experienced (vide table No. 1).

(*d*) Out of the total number of floods during the above mentioned period, the floods of high magnitude are the least (25.3%) and the low floods account for the highest percentage of occurrences (38.1%).

(*e*) So far as the bearings of the time of occurrences of floods are concerned, they have influenced in manifold ways the cultural operations of agronomy.

The Brahamani

The maximum gauge reading of the Brahamani at Jenapur for one day only from July to September for a period of 53 years (1875-1929) reveals the following salient features of the floods in her deltaic plains.

(*a*) Within a period of 53 years there have occurred 13 floods of high magnitude[6], 15 and 25 floods of medium and low magnitude respectively (Vide table No. 3). Thus the probability of occurrences of floods is 4.07, 3.53 and 2.12 years in case of high, medium and low floods respectively and hence the probability of occurrences are proportional to their intensity. During the year 1926 the maximum level has been reached at Jenapur when the gauge recorded 70.6 ft. The frequency of occurrences in case of floods of varied magnitudes show no definite trend excepting the feature that there has been a strikingly marked rise in case of high floods and decline in other two types during the decade 1918-27 (Vide table No. 2).

(*b*) As regards the time of occurrence of high floods they start from 21st July and continue to occur upto mid-September with two peaks in the curve (Vide Graph No. 1). Within a period of two weeks (21st July to 7th Aug.) 53.85% of the total occurrence is experienced whereas in a week only 15th Aug.-21st Aug. 23.08% of floods occur. The time limit for the occurrences of floods of medium height are taken shorter (1875-1929) which generally occur from 21st July and abruptly end by the 7th Sept. There are two peak periods of almost equal height, one being from 21st July to 7th Aug. and the other from 15th Aug. to the end of the month during which 46.67% (each) of the floods are experienced. The floods of low magnitude begin to occur from the 7th July to 21st Sept. with three peak periods (7th—15th July ; 21st July—7th Aug, and 21st Aug—7th Sept). There are two peak periods of occurrences in the river Brahamani when the floods in general are considered from 21st July to 7th Aug. 37.71% and from 15th Aug. to the end of the month 28.29% of the total number of floods are experienced.

(*c*) Almost all the peak periods of occurrence of all type of floods are met with from 21st July to 7th Aug., while the second peak period is not so very conspicuous like that of the Mahanadi, as it ranges over a comparatively wide period (15th Aug—7th Sept).

(*d*) The floods of high magnitude account for 24.53% of the total number of floods visited and it is the least of all the three types (vide table No. 3) while the floods of low magnitude top the list as they are 47.033% of the total.

The Baitarani

The maximum gauge reading of the Baitarani at Akhuapada for a period of one day from the month of July to Sept. of 1874 to 1929 lead us to the following conclusions :

(*a*) Within a period of 55 years there have occurred 9 high floods,[7] 11 medium and 4 floods of low magnitude (Vide table No. 4). The probability of occurrence is in 6.11 years in case of high floods whereas in the case of other two types of floods they stand at 5.00 and 1.57 years respectively and hence the probability of occurrences of floods is proportional to its magnitude. In the case of Baitarani there is absolutely no definite trend in frequency of occurrences of floods but during the ten years ending 1927 the low floods are of the maximum number. The highest gauge reading was recorded on the 20th Aug. 1907, when the flood crest reached a height of 66.2 ft.

[6] Years of high flood: 1881, 1883, 1888, 1894, 1896, 1907, 1913 ,1920, 1922, 1923, 1926, 1927 & 1929.

[7] Years of high floods: 1821, 1894, 1896, 1900, 1902, 1904, 1907, 1925, & 1927.

Flood Frequencies in Major Rivers of Orissa

TABLE No 1

Flood frequency in the Mahanadi (according to the gauge readings at Naraj from 1868-1929 and 1930-1954)

Type of floods	*June*		*July*				*August*				*September*				Total	In the % of total
	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th		
High floods	—	1	2	1	—	3	3	1	1	4	—	—	—	—	16	25.3
(In %)	—	6.25	12.50	6.25	—	18.75	18.75	6.25	6.25	25.00	—	—	—	—	100.00	
Medium floods (In %)	1	—	2	—	1	5	2	1	4	2	2	1	1	1	23	36.6
	4.35	—	8.70	—	4.35	21.72	8.70	8.35	16.38	8.70	8.70	4.35	4.35	4.35	100.00	
Low floods	—	—	—	1	—	4	2	4	3	5	2	3	—	—	24	38.1
(In %)	—	—	—	4.16	—	16.66	8.32	16.66	12.50	20.83	8.32	12.55	—	—	100.00	
Total	1	1	4	2	1	12	7	6	8	11	4	4	1	1	63	100
(In %)	1.57	1.57	6.35	3.17	1.57	19.04	11.11	9.52	12.69	17.47	6.35	6.35	1.57	1.57	100.00	
High floods*	—	—	—	1	—	—	3	—	—	2	2	—	—	—	8	32.0
Medium floods	—	—	—	—	—	—	3	3	1	1	1	1	2	—	12	48.00
Low floods	—	—	—	—	—	—	2	1	1	—	1	—	—	—	5	20.00
Total	—	—	—	1	—	—	8	4	2	3	4	1	2	—	25	100.00
(In %)	—	—	—	4.00	—	—	32.00	16.00	8.00	12.00	16.00	4.00	8.00	—	100.00	
Grand total	1	1	4	3	1	12	15	10	10	14	8	5	3	1	88	—
(In %)	1.14	1.44	4.55	3.41	1.14	13.63	17.04	11.36	11.36	15.91	9.09	5.68	3.41	1.14	100.00	—

*Floods from 1930-54 have been calculated. Danger level is at 87.00 ft.
High floods—90.00 ft. or above
Medium floods—87.00 ft. or above
Low floods—below 87.00 ft.

TABLE No 2

Occurences of floods in Orissa (1868-1955)

Floods	1868-77	1878-87	1888-97	1898-1907	1908-17	1918-27	1928-37	1938-47	1948-55	Total
Mahanadi										
High floods	2	2	3	—	4	4	4	5	—	24
Medium floods	4	4	2	3	5	3	6	3	4	34
Low floods	4	4	4	7	1	3	—	2	3	28
Brahmani										
High floods	—	2	3	1	1	5	5	3	1	21
Medium floods	—	2	0	5	5	3	3	3	1	22
Low floods	3	6	5	4	4	2	2	2	1	29
Baitarani										
High floods	—	1	2	4	—	2	—	1	—	10
Medium floods	—	—	2	—	3	3	2	2	—	12
Low floods	4	7	6	6	7	5	6	6	7	54

TABLE No 3

Flow frequency in Brahmani (according to the gauge reading at Jenapur, above weir, on the right bank are calculated from 1875-1929 and 1930-1955)

Type of floods	*July (in quarters)*			*August (in quarters)*				*September (in quarters)*			*Total*	*In % of the total*
	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd		
High floods	—	1	5	2	—	3	1	—	1	—	13	24.53
(In %)	—	7.69	38.46	18.39	—	23.08	7.69	—	7.69	—	100.00	
Medium floods	—	—	4	3	—	3	4	1	—	—	15	28.30
(In %)	—	—	26.67	20.00	—	20.00	26.67	6.66	—	—	100.00	
Low floods	4	1	4	2	3	1	3	4	2	1	25	47.17
(In %)	16.00	4.00	16.00	8.00	12.00	4.00	12.00	16.00	8.00	4.00	100.00	
Total	4	2	13	7	3	7	8	5	3	1	53	100.00
(In %)	7.54	3.83	24.51	13.20	5.66	13.20	15.09	9.43	5.66	1.88	100.00	
High floods*	2	—	—	1	1	1	1	2	—	—	8	42.10
(In %)	25.00	—	—	12.50	12.50	12.50	12.50	15.00	—	—	100.00	
Medium floods	1	1	1	1	2	—	1	—	—	—	7	36.84
(In %)	14.29	14.29	14.29	14.29	28.55	—	14.29	—	—	—	100.00	
Low floods	—	—	—	1	1	—	—	—	2	—	4	21.06
(In %)	—	—	—	25.00	25.00	—	—	—	50.00	—	100.00	
Total	3	1	1	3	4	1	2	2	2	—	19	100.00
(In %)	15.79	5.26	5.26	15.79	21.05	5.26	10.53	10.53	10.53	—	100.00	—
Grand Total	7	3	14	10	7	8	10	7	5	1	72	—
(In %)	9.72	4.17	19.45	13.89	9.72	11.11	13.89	9.72	6.94	1.39	100.00	—

*Floods from 1930-1955 has been calculated
High floods—68 ft or above.
Medium floods—66 ft or above. (danger level)
Low floods—below 66 ft.
Average maximum high floods—70.00 ft.

TABLE No 4

Flood frequency in the Baitarani

(Gauge readings at Akhuapada. below weir and on the left bank are calculated from 1874-1929 and 1930-1954. Maximum height for a day of the whole year is considered)

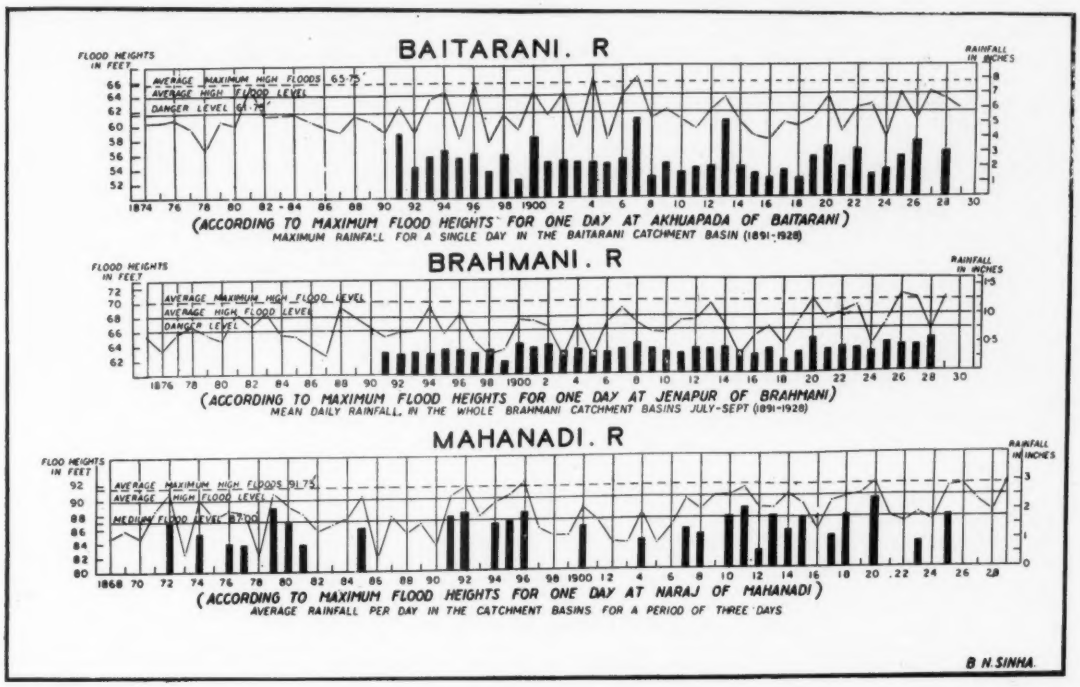
Type of floods	*July (in quarters)*				*August (in quarters)*				*September (in quarters)*				*October (quarters)*	*Total*	*In % on the total*
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st		
High floods	—	1	2	3	—	—	1	1	—	—	—	1	—	9	16.37
(In %)	—	11.11	22.22	33.34	—	—	11.11	11.11	—	—	—	11.11	—	100.00	
Medium floods	—	—	—	4	1	2	1	—	1	2	—	—	—	11	20.00
(In %)	—	—	—	36.37	9.09	18.18	9.09	—	9.09	18.18	—	—	—	100.00	
Low floods	1	2	1	6	1	3	4	4	6	2	3	1	—	34	63.63
(In %)	2.86	5.72	2.85	17.15	2.86	8.85	71.42	11.42	17.15	5.72	8.85	2.86	—	100.00	
Total	1	3	3	13	2	5	6	5	7	4	3	2	—	54	100.00
(In %)	1.82	5.45	5.45	23.64	3.64	10.91	10.91	9.09	12.73	7.27	5.45	3.64	—	10.000	
High floods*	—	1	—	—	—	—	—	—	—	—	—	—	—	1	4.55
(In %)	—	—	—	—	—	—	—	—	—	—	—	—	—	100.00	
Medium floods	—	-	-	-	1	-	-	-	-	-	-	-	-	1	4.55
(In %)	—	—	—	—	100.00	—	—	—	—	—	—	—	—	100.00	
Low floods	2	—	1	2	5	1	1	3	—	—	2	2	1	20	90.90
(In %)	10.00	—	5.00	10.00	25.00	5.00	5.00	15.00	—	—	10.00	10.00	5.00	100.00	
Total	2	1	1	2	6	1	1	3	-	-	2	2	1	22	100.00
(In %)	9.10	4.54	4.54	9.10	27.27	4.54	4.54	13.63	—	—	9.10	9.10	4.54	100.00	
Grand total	3	4	4	15	8	6	7	8	7	4	5	4	1	76	
(In %)	3.95	5.26	5.26	19.74	10.52	7.90	9.21	10.52	9.22	5.26	6.58	5.26	1.32	100.00	

*Floods from 1930 upto 1954 have been considered.
High floods—64.00 ft or above.
Medium floods—61.75 ft. or above.
Low floods—below 61.75 ft. or above.
Danger level—61.75 ft. from 18.74—1929 ; 63.10 ft from 1931-1955.

TABLE No. 5

Probablity of flood occurences.

Rivers	*No. of years observed* (1868-1955)	*High floods*		*Medium floods*		*Low floods*	
		No. of occurences	*Probablity of occurences (in yrs.)*	*No. of occurences*	*Probablity of occurences (in yrs.)*	*No. of occurences*	*Probablity of occurences (in yrs.)*
Mahanadi	87	25	3.48	34	2.55	28	3.10
Brahmani	72	21	3.42	22	3.25	29	2.48
Baitarani	76	10	7.60	12	6.33	54	1.40


BAITARANI. R
FLOOD HEIGHTS IN FEET
RAINFALL IN INCHES
AVERAGE MAXIMUM HIGH FLOODS 63·75'
AVERAGE HIGH FLOOD LEVEL
DANGER LEVEL 61·70'
(ACCORDING TO MAXIMUM FLOOD HEIGHTS FOR ONE DAY AT AKHUAPADA OF BAITARANI)
MAXIMUM RAINFALL FOR A SINGLE DAY IN THE BAITARANI CATCHMENT BASIN (1891-1928)
BRAHMANI. R
AVERAGE MAXIMUM HIGH FLOOD LEVEL
AVERAGE HIGH FLOOD LEVEL
DANGER LEVEL
(ACCORDING TO MAXIMUM FLOOD HEIGHTS FOR ONE DAY AT JENAPUR OF BRAHMANI)
MEAN DAILY RAINFALL IN THE WHOLE BRAHMANI CATCHMENT BASINS JULY-SEPT (1891-1928)
MAHANADI. R
AVERAGE MAXIMUM HIGH FLOODS 91·75'
AVERAGE HIGH FLOOD LEVEL
MEDIUM FLOOD LEVEL 87·00'
(ACCORDING TO MAXIMUM FLOOD HEIGHTS FOR ONE DAY AT NARAJ OF MAHANADI)
AVERAGE RAINFALL PER DAY IN THE CATCHMENT BASINS FOR A PERIOD OF THREE DAYS
B N SINHA.

Graph No. 2.

(*b*) As regards the periodicity of occurrence of the high floods in the river Baitarani they are experienced in three phases with long gaps of several weeks at times, which is strikingly a peculiar feature with this river. Floods of high magnitude start to occur from the second quarter of July and continue upto the end of the month. Then with a spell of about four weeks the frequency of floods of high magnitude recurs from the 15th August to the end of the month, while the last phase of expected occurrence is the last week of Sept. The peak period of the floods of this type is expected to be in the last quarter of July during which 33.34% of the total visits are recorded (vide table No. 4) and Graph No. 1). The case of medium flood is somewhat the same and it makes one highpeak of occurrences followed by two minor ones with "lows" in between them. Yet the maximum flood period occurs from 21st July to the end of the month when as much as 37.37% of the total number of visits are experienced. The other peak periods are from 7th Aug. to 15th Aug. and from 7th to 15th Sept. The low floods begin to occur from 7th July and the probability of its occurrence continues upto the end of Sept. with the maximum peak period from 21st July to end of the month during which 17.15% of the total occurences are experienced. During the 1st quarter (1st to 7th Sept.) 17.15% of the low floods also visit the delta areas and then become infrequent. The floods in general are more frequent from the 21st to 30th July during which 23.64% of the total floods, visited from 1874 to 1929.

(*c*) In case of Baitarani, floods of all magnitudes are most frequent during the period from 21st July to the end of the month as these seven days account for 23.64% of the total number of floods. Another low peak in the frequency curve is met with from 1st Sept. to 7th of the month (vide table No. 4).

(*d*) The percentage of the floods of high intensity is the lowest while the low floods are the highest, of the total number of floods that have occurred in the deltaic area of Baitarnai.

General conclusions

(*a*) The probability of frequency in occurrences of floods varies according to the difference in flood magnitudes in all the major rivers of Orissa. The high level floods are rarest while the low floods occur more frequently (vide table No. 5).

(*b*) The greater the river, the lesser is the gap in occurences of high and medium types of floods. The Mahanadi, the biggest river in Orissa, has got the greatest frequency of the visit of high floods while the cases of Brahamani and Baitarani stand next in order of arrangement. But no such trend is to be marked in case of floods of low intensity.

(*c*) A study on flood occurrences in Orissa during last 87 years (1868-1955) reveals that the number of high and medium floods varies according to the size and discharge of the rivers concerned. Mahanadi, the biggest one of the river system of Orissa, has experienced maximum number of high and medium types of floods while Brahamani and Baitarani stand next in order of arrangement. But in case of low floods the order of arrangement is just the reverse of the former. In Baitarani, the smallest of the three, maximum number of low floods have occurred while the Mahanadi, the biggest of all, has experienced least number of low floods during the periods under discussion (vide table No. 2).

(*d*) The common years of high floods in the Mahanadi, Brahamani and Baitarani are disastrous to the respective deltas in the sense that the combined

waters of the Mahanadi and Brahamani are discharged to the sea through a common mouth while it is almost the same in Brahamani and Baitarani. This happens because of the water, to be discharged through the common mouths, far exceeds the discharging capacity as a result of which floods linger and the damage to life and property is extensive. Such bad years of common high floods in Mahanadi-Brahamani delta was experienced in the year 1896, 1920, & 1929. In the year 1896 Baitarani also experienced a high flood and thus it must have been a disastrous year for the entire plain stretching from the lake Chilka in the west to the river Salandi in east. The years of common high floods in Brahamani and Baitarani were in 1881, 1894, 1907, 1927 during which the gauge reading at Jenapur in the Brahamani and Akhuapada in the Baitarani topped the high flood level mark.

(*e*) The maximum frequency of the occurrence of floods of all magnitudes is experienced in two phases of the monsoon season (from 21st July-7th Aug. and 21st Aug-7th Sept.) and this being the season for transplantation and weeding in case of paddy, harvest season for 'Biali' (Summer paddy) and above all for a cash crop like Jute, it is the season of weeding for the second time and harvesting, these floods cause extensive damage to the standing crops. Hence any move to plan for better agricultural yield, must primarily be aimed at deferring the present transplanting and weeding periods in case of winter paddy and harvest season of summer paddy so that they will not suffer serious damage from frequent flood visits. By research work, paddy seeds may be made 'late-riping' or 'early-mature' variety so that particularly transplanting and weeding will be taken up either before the floods or after them as during these periods they are weak to resist and fail to stand flood water.

D.V.C. Inter-State Conference Recommendations

Fourth Unit for Bokaro Thermal Station

The conference of the Union, West Bengal and Bihar Governments, participating in the Damodar Valley Corporation project, has recommended that the Corporation should be permitted to install a fourth unit at the Bokaro thermal power station during the second Five-Year Plan period. Three units of 50,000 k.W. each are already operating at Bokaro. Whether the capacity of the proposed unit should be 50,000 kW. or 75,000 kW. was left to be determined on the basis of technical considerations.

The conference discussed the question of providing alternative employment to surplus D.V.C. personnel. Efforts made recently by the Ministry of Irrigation and Power in cooperation with the Governments of West Bengal and Bihar had resulted in the re-employment of about 400 skilled workers. The two State Governments had further given the assurance that they would endeavour to employ as many of the remaining workers as possible. The Union Ministry of Iron and Steel and the private industry in the area were also willing to absorb a certain number of workers.

The D.V.C. authorities were in touch with the other project authorities and had deputed a Deputy Director to go round and examine the scope of employment on these projects.

The Kosi Project in Bihar had taken about 40 skilled workers from Maithon. The Bihar Government had also set up an organisation to assess its requirements and, it was hoped, some more would be provided work on the Project in the near future.

The conference recommended for adoption the suggestion that re-training schemes for the surplus technical staff should be started wherever necessary. The conference felt that the demand of the Staff Association that there should be "no retrenchment without alternative employment" was not acceptable.

Revised Estimates

The report of the Ad Hoc Committee on estimates was discussed. Subject to further enquiry on certain points, the revised estimates of Rs. 101.3 crores, as worked out by the Committee, were approved.

Regarding the schemes proposed by the D.V.C. for inclusion in the second Five-Year Plan, the conference recommended that six head-water control work schemes, which had already been examined by the C.W.P.C. might be sanctioned. These schemes are estimated to cost about Rs. 70 lakhs. The remaining 13 schemes would be considered after investigations had been completed. A provision of Rs. 10 lakhs for taking up investigations for river control work in the Lower Damodar Valley was recommended.

The conference was of opinion that afforestation in the upper catchment of the Damodar and its tributaries might be done by the D.V.C. in highly eroded areas, while in others the Bihar Government might undertake the work. Agriculture development works, such as soil conservation and farming, were also approved. Proposal for an agriculture farm at Panagarh and the development of fisheries in the D.V.C. reservoirs were agreed to.

The conference approved of an expenditure of Rs. 11 lakhs for the development of tourist resorts.

The conference felt that the Corporation should not undertake new small-scale industries, but might continue to carry on the industries already started in case the State Governments were unwilling to take them over. In future the Corporation should ordinarily confine itself to arranging power facilities for the development of small-scale industries.

Konar Hydro-Electric Station

In view of the approval of the recommendation to set up a thermal power station at Durgapur, the conference was of opinion that the economics of the Konar Hydro-electric station should be further studied.

The other power schemes relating to extension of the existing grids and stations and construction of new receiving stations, conversion of single circuit lines from Bokaro to Gaya, Patna and Dalmianagar into double circuit lines and installation of sub-stations at Howarh and Burdwan were accepted.

Regarding the utilization of D.V.C. water for irrigation in West Bengal, the State Government promised to do its best in the matter. The conference was informed that the scheme for irrigation from Tilaiya reservoir in Bihar was under the State Government's consideration.

"Must have complete investigations and comprehensive schemes"

By

GULZARI LAL NANDA

Minister for Irrigation and Power, Government of India

AUTHOR

Mr. Gulzarilal Nanda, Union Minister of Irrigation and Power and Planning, said on June 21, that flood protection work should be given the topmost priority in the nation's programme of development.

Mr. Nanda, who was addressing the fifth meeting of the Central Flood Control Board held under his chairmanship, said though the allotment for flood control schemes in the Second Plan had been reduced to Rs. 60 crores against the Irrigation and Power Ministry's proposal for Rs. 117 crores, he would try to get more money if it was warranted by the progress of work.

He expected that about Rs. 8 crores would be spent on flood protection works during this year and about Rs. 5 crores on investigations during the Second Plan period.

The country, he said, was now embarking on the second phase of flood protection work which involved short-term measures like the construction of small detention reservoirs. This development had been made possible by satisfactory progress and completion of a number of emergency schemes, investigations and collection of a large volume of data, and the setting up of a well-knit, strong, flood control organization for coordinating and resolving technical and administrative matters.

Mr. Nanda emphasised the need for expeditious completion of investigations and collection of data so that well-considered schemes could be started soon. "As we came face to face with the problem in the country, we discovered that not only what was feasible and possible in the way of flood protection programme had not been carried out in the various parts of the country but also that the basic data and information which one derives from investigations and on the basis of which schemes can be evolved or carried out, were almost totally lacking. So that even with money, it was not possible to carry out any schemes".

He urged that investigations should be completed within six or seven years so that works carried out would be technically sound. He said, "Whatever we have done in the matter of investigations has convinced us that a great deal has yet to be done and it has to be done in different ways. It is not merely investigations here and there."

"We must have complete plans, draw out comprehensive schemes, and decide on our methods and sites and the design of our projects with due regard to costs and benefits. It is better to have a full view of the cost of these investigations and it will be, relatively speaking, insignificant. I believe there is some kind of reluctance to undertake the investigations. I think we may settle the difficulties, if any, in any way, but let this work of investigations be not held up."

Regarding the work done he said : "We have carried out aerial surveys, ground surveys covering 44,000 sq. miles and photography 16,000 sq. miles. Thirty rain gauge stations were established and 200 discharge stations and 50 silt observation stations were set up."

As to the progress of execution of works, Mr. Nanda said that the headway had been "very satisfactory. Whatever works have been carried out, have withstood the floods very well. At Dibrugarh the position was retrieved by the efforts of all agencies."

FIFTH MEETING OF CENTRAL FLOOD CONTROL BOARD

Nineteen flood control schemes, costing more than Rs 10 lakhs each, proposed by the various States were approved at the fifth meeting of the Central Flood Control Board held on June 22, under the chairmanship of Mr. Gulzarilal Nanda, Union Minister for Irrigation and Power and Planning.

These schemes include the construction of embankments, town protection works and raising the level of villages.

Tentative allocations totalling about Rs 7.5 crores for flood control projects this year were made to various States. These allocations would enable the States to go ahead with their works without further delays.

A view of the fifth meeting of the Central Flood Control Board.

The positions would be reviewed after two or three months when fuller information about these schemes was available. An attempt would then be made to obtain more funds, if necessary.

The Board was of the view that no hard and fast financial restrictions should be placed on the States regarding their construction programme for the Second Five-Year Plan and allocations should be governed by considerations of progress and capacity to execute the works. The pace of work need not necessarily be determined by the allocation of Rs. 60 crores for the entire plan period. If progress warranted, the amount could be spent earlier.

The States were advised to take immediate steps to formulate schemes for inclusion in the Second Five-Year Plan. The States were also asked to furnish complete data in regard to the schemes together with the order of priority in which they would like to execute them.

The Board recommended that all flood protection works in a State should be brought under the unified control of the State Flood Control Department to ensure coordinated action. The State Flood Control Departments should notify the works which would fall under this category.

A sub-committee composed of the Irrigation Ministers of Bihar, Punjab and U.P. was appointed to go into the question of sharing of expenditure between the States and the Centre on surveys and investigations for ensuring an integrated flood control plan for the country.

The Board reviewed the action taken by the Ganga River Commission for resolving the conflicting interests of the States of Uttar Pradesh and Punjab and the Northern Railways in regard to the Yamuna River bunds. It was decided that the representatives of the Central Water and Power Commission and Railway Board, and the chief engineers of Punjab and U.P. should study the question and examine jointly the facts of the case.

The question of soil conservation was discussed and the value of this in flood control in so far as elimination of coarse silt was concerned was recognised. It was decided that the financing of soil conservation schemes should be taken up after the results of investigations in hand became known. The investigations for soil conservation schemes in river valleys would be financed from the provision of Rs. 50 lakhs for soil conservation surveys in the Second Plan.

The Board reviewed the progress made in respect of surveys, investigations, planning and design, and also new schemes drawn up in this connection. It urged the State Governments to expedite the collection so data so that progress of flood control works could be more rapid and decisions on new schemes could be taken soon. The Board hoped arrangements made for collecting hydrological and meteorological data in the bordering Himalayan countries would be completed soon with the co-operation of the countries concerned.

The Board considered the recommendations of the Central India River Commission, the North-West River Commission, the Ganga River Commission and the Brahmaputra River Commission. The Board recommended that the construction of a railway bridge in Bihar at Kamla-Balan crossing near Hinjharpur necessitated by the change in the course of the Kamla should be expedited.

It noted that action was being taken in connection with the widening of the railway bridge on Kirohi River. The progress of work on the Samastipur embankment in North Bihar, Dalaghai Protection Works in Orissa and Shahadar bund along the Yamuna was reviewed. It was noted that these schemes would be able to afford protection to the areas during this monsoon.

The Board also considered arrangements for flood warning and the question of procurement of flood warning equipment. The Board noted that almost all the States had an effective internal flood warning system. Some of the States, which have still to set up an organisation, were requested to proceed with this work immediately.

The Board decided that the flood wing of the CWPC should be continued for a further period of five years.

Developments in Electrical Engineering

Products shown at London Exhibition

By

FRANK CLAWES

India recently concluded an agreement with Associated Electrical Industries of Britain to act as consultants to the scheme for creating a heavy electrical industry in India. For a basic period of 15 years A.E.I. will provide a resident engineer and technical specialists, advising on the planning of factories and the training of the staffs to man them. India is a good customer of the British electrical industry. In 1955 India imported from Britain electrical machinery, apparatus and appliances worth £ 16,245,707—about eight per cent of all such British exports. Viewed against this business association between the two countries it is not surprising that India was particularly well represented among the over-sea visitors to the fifth Electrical Engineering Exhibition held recently at Earls Court, London.

Arranged by the Association of Supervising Electrical Engineers of Britain, the number of exhibitors exceeded 300 and the number of pieces displayed exceed 25,000, of which, the organisers claimed, no less than 2,500 were new products shown for the first time. There were 51,000 visitors to the show this year.

Once more there was keen interest among oversea buyers, for whom special officers and reception rooms had been set aside. A party of 25 Russian technicians on a study tour of British industry visited the exhibition three times.

Miniature Switches

The most impressive sights of electrical exhibi-

A general view of the 1956 Electrical Engineers exhibition at Earle Court, London.

Mr. H. W. Hulme, the designer, with the clifton Dynamic Balancing Machine

tions are normally the gigantic transformers, switchgear and so on ; the apparatus of grand-scale power production. But this time among the most remarkable exhibits were the new miniature switches of Burgess Products Company Ltd. Their V4 is a new switch ; 12 can be packed in a match-box, and each is no bigger than a thumbnail. It has been designed for use in restricted space ; it may be mounted in banks for multi-pole switching or singly for limiting travel, controlling sequences, or initiating safety devices ; it is capable of handling 5A at 250B a.c.

This firm was also showing the new micro switch V10, which is operated by the flick of a wire actuator and is specially interesting to the textile industry and to makers of instruments and coin-operated mechanisms.

Switchgears

Naturally, switchgear of all kinds was a prominent feature of the show. The firm of A. Reyrolle and Company Ltd. was showing its new range of rural switchgear units comprising both extensible and non-extensible oil switches and oil-immersed fused switches for 11 kV service. South Wales Switchgear Ltd. had a number of switchgear exhibits of a heavy industrial calibre, and, in addition, a scale model of a new air-insulated 33,000V, 1,000 MVA outdoor metal-clad switchboard with vertical isolation, oil circuit breakers. It is a range of switchgear that shows substantial saving in both space and speed of erection over conventional outdoor sub-stations, since each unit is self-contained within its fully weather-proofed housing.

George Ellison Ltd. had a complete range of switchgear, but made a special show of an 11kV 250MVA circuit breaker unit and a 660V 45MVA switchboard. The 11kV circuit breaker unit is available for 3-phase systems. The circuit breaker is vertically isolated, and is supported on a wheeled truck easily withdrawn for inspection. Safety interlocks are incorporated and are easily removable for contact inspection. The unit may have single or duplicate busbars with or without selector switches, and may be operated manually or power-closed by spring or d.c. solenoid.

Electronic Equipment

Electronic equipment formed a fascinating section of the exhibition. The Dowty Group was showing an electronic counter ; using two Dekatron counter tubes and a high-speed electro-mechanical register, it is capable of counting electrical impulses at the rate of 300,000 a minute. Also being demonstrated on the stand was a working model of a new electronic tachometer for accurately registering retational speeds up to 1,200,000 r.p.m.

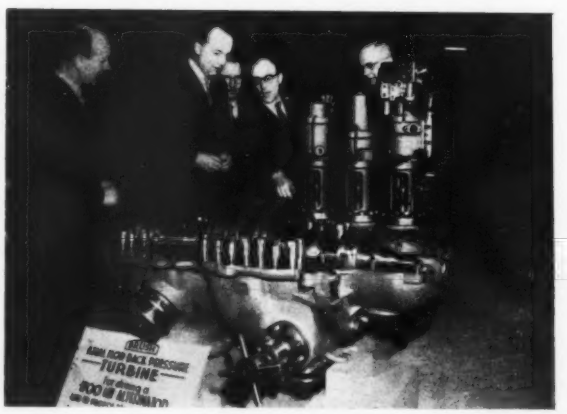
E.M.I. Electronics Ltd. took "electronics in industry" for the theme of its stand, and neatly illustrated the application of the 3C high powered white light stroboscope. The E.M.I. emblem could be seen rotating rapidly against a map of the world. By pressing a button the stroboscope lamps could be siwtched on and the emblem appeared to stop, although the physical rotation was unaltered. The stroboscope's capacity for visually arresting the motion of machinery is invaluable for the measurement of speed and the observance of rotating or reciprocating mechanisms of all kinds.

Some New Instruments

A completely new instrument shown for the first time was an electronic tachometer designed for precision measurement of rotary shaft speed but also suitable for any similar applications where knowledge of the repetition rate of cyclic events is required. The instrument will count the revolutions occurring in a period of 1, 2 or 4 seconds as required, the count being displayed on four Dekatron valves for approximately 1.5 seconds. Alternatively, it may be switched to a manual position, when it will begin to count after a button is pressed and the count is displayed and held till after the button is pressed again. This instrument will count any train of events which can be arranged to provide an electrical input of not less than 0.3V peak to peak in the frequency range 250-3,000 can be extended to 100c/s to 5kc/s, if the inputvoltage c/s. This is not less than 5V R.M.S. The accuracy is within one part in 10^4 or—1c/s, whichever is the greater.

Philips Electrical Ltd. had a range of electronic instruments, including for the first time the P.R. 9151 roughness tester—a portable instrument for measuring surface finish. Ferranti was showing a new large mercury computer for scientific work.

A Steam Turbine of Brush Electrical Engineering Company, for driving 1,700 kw Alternator



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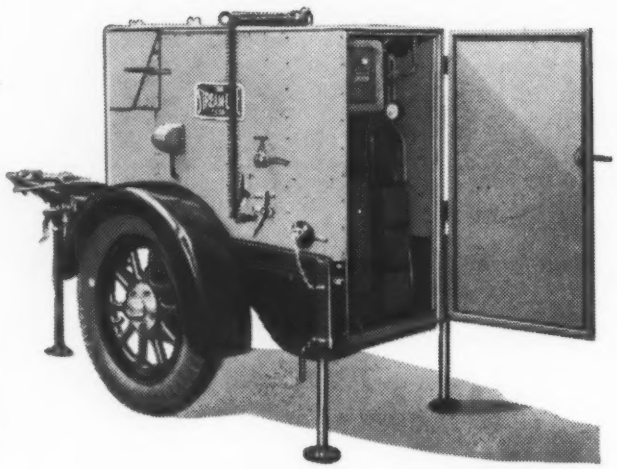

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Prize-Winner

Another piece of electronic equipment—which won the prize as the outstanding new industrial exhibit at the show—was an electronic dynamic balancing machine capable of detecting displacements of $\frac{1}{1,000,000}$ inch and of balancing 1,200 small motor armatures in a shift. It was shown by Small Electric Motors Ltd. Of the runners-up in the competition one was an impressively robust 15A safety plug and socket made of rubber and steel and capable of withstanding the roughest treatment and weather. It was made by Light and Power Accessories Ltd. The other was the S144 Form 4 "Servo Pot" shown by Sangamo Weston Ltd. It is an inherently stable self-balancing potentiometer with a negligible input current. It has a built-in cold end compensation for thermocouple input.

There were some interesting samples of cables. Standard Telephone and Cables Ltd. showed its C.M.A. disaster cable for mines. This is of rubber insulated construction, glass fibre braided, and even if the cable is largely destroyed by fire, the residue of the insulation will be enough to allow telephone communication to be maintained. This firm was also showing a new rubber-filled communication cable for use in ships, armoured P.V.C. insulated and sheathed control-cable, and 6-pair polythene telephone cable. British Insulated Callender's Cables Ltd. had a wide selection of cables, and included among them a new mineral-insulated copper-sheathed cable.

New Materials

Finally, mention might be made of a few of the new materials available for electrical work. Midland Silicones Ltd. showed silicone rubbers which will vulcanize at room temperature; they can be used continuously at 150° deg. C and intermittently at 200° deg. C. Imperial Chemical Industries Ltd. also showed silicone rubbers and demonstrated how they retain their elasticity at rigorous temperature extremes. Henry Wiggin and Company Ltd. showed the use of nickel alloys in electrical work; Turners Asbestos Cement Company Ltd. had among its insulation materials a new range of Electrofine Asbestos Papers, silicone or PVA resin bonded with highly-refined asbestos fibre base and available for air-cooled transformers, slot linings and so on.

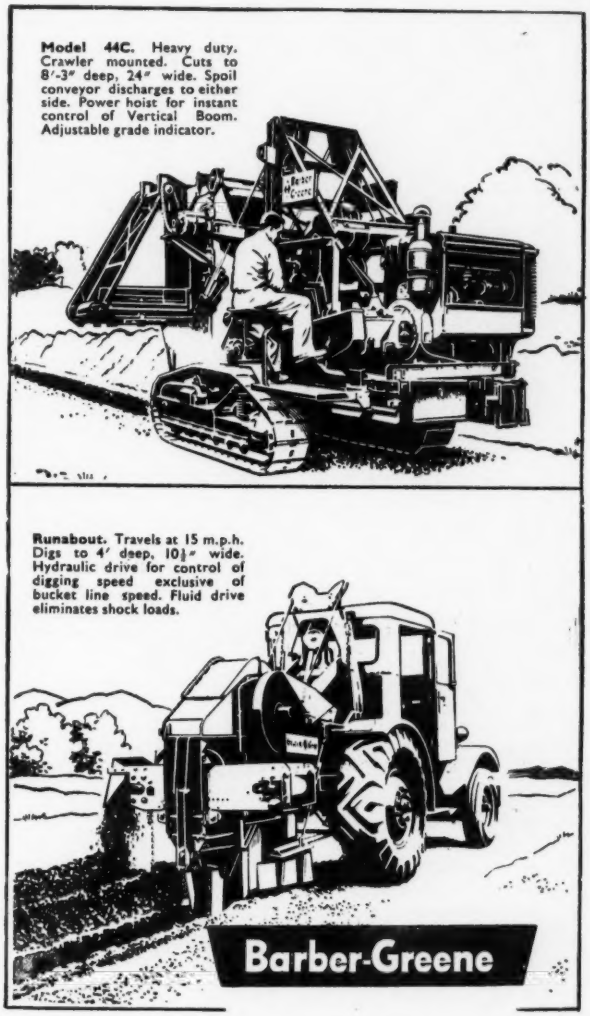
Mekong Reconnaissance

A reconnaissance of certain stretches of the Mekong in Cambodia and Laos has been carried out in the last few weeks by an ECAFE team of outstanding water resources experts.

The team visited in particular the area around the Great Lake, Sambor rapids, the Khong Falls, the Kemerat rapids and the part of the river some distance upstream of Vientiane.

After completion of the tour the members of the team held discussions at ECAFE's headquarters in Bangkok in preparation of a report which is to include certain specific proposals for the development of the Mekong. Further data are now being collected.

It is expected that the report of the group will be completed in September.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No. 105B.D.

Musings of an Indian Engineer in USA

It is vitally important in the irrigation and power projects of India that arrangements are made for the training of graduates in the practical aspects of engineering science. This practical aspect should extend down to "*the grass roots*," and our engineers should be able to "*handle*" with their own hands the equipment, whether in the laboratory, drawing office, or the field. Handling means complete understanding and maintenance and repair work. Also, when something gets out of order, the graduates should be ready always to roll up their shirt sleeves and to get down to work to fix the equipment themselves.

New awareness needed at the top

This consciousness must first start with the higher-ups. They must know that it is not in books or in drawings alone that engineers can be developed, but on the other hand, Engineering needs to be followed up in its relatively dirty processes of mucking, excavating, hauling, mixing, and laying of materials. Now that Indian projects are being mechanized to a large extent, the success of such work will depend principally on how well the equipment performs, and how efficiently it is looked after.

Upper Colorado River Storage Development to cost $ 800 millions

The United States are having big programs of development works in the irrigation and power fields. They have usually a multiple-purpose aspect for their projects. In the last few months, after a lot of controversy, sanction of the U.S. Government has been coveyed to the construction of the Upper Colorado River Development. This is a huge project, which involves an expenditure of about $ 800,000,000 and is expected to last, may be, from 6 to 10 years. Hence, U.S. personnel and equipment are largely going to be tied up in their own domestic needs.

Still more water for Irrigation in Western States

It is important to note that the Western United States, after having successfully completed a 365 billion-dollar program in the last 50 years are even now not relaxing on further expansions of their reclamation work. There is a lot of desert land which is without timely rainfall on which big farms have been created in these Western States. Such lands can give much higher production and a more easy time to the farmers if they have the benefits of assured water supply. Although water is used in the United States in a most conserved manner, yet the thirst of the land is not quenched with what has been done already. Hence, the ever-increasing necessity of further research and construction programs on which the engineers of the Bureau of Reclamation are enthusiastically engaged.

Further mechanization needed on India's Projects

It will become increasingly necessary in India that mechanization receives further scientific study. It is in the present day the only way to expand the programs of development without unduly adding to cost and time. With the progress of manufacture of steel and consequently of some of the parts of construction equipment in India, the economics will be more heavily in favor of mechanized construction. Those who are of a progressive mind should understand this inevitable fact and not advocate and agitate in the traditional style insisting on keeping more employment for India's manual workers by the exclusion of machines. It is the experience of all progressive countries that with the introduction of machines there are more jobs (and higher jobs) for everybody, and there is no reduction in overall employment.

Research required for new Irrigation pattern from Storage waters

With the introduction of irrigation from storage reservoirs in India, the question is soon going to come up whether the existing pattern of irrigation should not be modified to derive the best benefit from storage waters. In projects such as Bhakra, Hirakud, Tungabhadra, D.V.C., the problem is now going to be raised in an active form. Hence, for deriving the best benefit out of the huge investments, Government and engineers should lose no time in advocating some modernization of agricultural processes so that really *two blades of grass may be grown where only one was grown before*. It was recently considered by the representatives of the International Monetary Bank, who visited India, that the pattern of irrigation on the large dam projects must necessarily change in the near future. They thought that much of the land that now bears only a single crop will definitely be capable of raising two crops. This will influence the economics of these projects very favorably.

Central Construction Organization a need of the hour

Necessity is increasingly being felt that India should have a country-wide organization in charge of the planning, design, and construction of projects. In the first two fields, the scope and opportunity to the Central Water and Power Commission is wide, as they are acting as official Consultants to the Government of India and the Planning Commission regarding the review of projects. There is, however, no central organization in charge of the construction of development works in the irrigation and power fields. It is high time that a positive shape is given to this idea and a pooling of resources is effected by which the necessary talent is conserved for the accomplishment of this huge task at the deisred rate of speed. Such an organization will have full information and control over the major equipment of construction that now lies scattered on various projects. Also, this organization can absorb the experienced construction engineers from within the country who are otherwise going to retire in the near future. These older engineers can be supplemented by younger people in respect of the more active duties which involve physical strain. But their know-how and experience can be obtained from their own specific fields. In the United States such practice is not only common but is considered vital for proper progress.

Roorkee Refresher Course Lectures

A three-month Refresher Course in Civil Engineering is being started at this University for the Serving Civil Engineers from 16th July, 1956 and it will deal with the Design and Construction of Buildings, Soil Mechanics, High-Way Engineering and Bridges. Lectures on Buildings and Soil Mechanics will be helt from 16th July to 22nd August and on High Way Engineering and Bridges from 6th September to 11th October. The trainees will be taken on a tour to visit important construction works and laboratories in the country during the period 23rd August to 5th September, 1956.

The University has invited a number of eminent engineers for lecturing to the Refresher Course. Name of some of them who have agreed to participate are given below:

1.	Mr Harold Hay, Technical Adviser in Building Materials U.S.A. Cooperation Mission to India.	Development of New Building Materials in India.
2.	Sri P. L. Sharma, F.R.I.B.A., F.I.I.A., Chartered Architect,	Modern Building Architecture and Low Cost Building.
3.	Sri N. H. Mohile, B.E. Civil., Specialist from from Concrete Association of India Ltd,	Design and Construction or Earth Quake Resisting Buildings & Structures Multi-Storeyed R.C.C. Building
4.	Sri K. N. Misra, C.E., (Hons) A.M.I.E., A.M.A., S.C.E., A.M.A.I.P., A.I.T.P., (1), Town & Village Planner to U.P. Govt.	Housing and Town Planning in India.
5.	Sri S. N. Gupta, B.M. M.S., A.M.I.E.,S.E., Road Construction Circle.	Soil Mechanics.
6.	Mr. W. K. Fernlund, Expert United Nations Technical Assistant Administration.	Earth Moving Machinery & its use in Construction of High Ways, Bridges & Buildings.
7.	Sri C. L. Iyenger, Specialist from Concrete Association of India Ltd..	Concrete Road Construction including Prestressed Concrete Bridges.
8.	Sri Sujan Singh, Specialist from Burmah Shell,	Binder W.B.M. and Bituminous. Pavement Construction.
9.	Sri Brij Mohan Lal, M.I.E., I.S.E., (Retd.) Chief Engineer,	High Way Engineering.
10.	Sri Brij Narain, I.S.E, (Retd.)	Design and Construction of Bridges.
11.	Sri P. C. Poonen Deputy Bridges Officer, Govt of India, Ministry of Transport, Roads, Wing.	Design and Construction of Bridges.

This is rare opportunity for Serving Engineers to get the benefit of lectures from such eminent engineers of the country who will impart the latest techniques in the Design & Construction of Buildings, Roads and Bridges.

MECHANICAL ENGINEERING

The Refresher Course in "Mechanical Engineering" for the Serving Engineers in the country will be held from 18th of October, 1956 to 14th of January, 1957 at this University.

A tentative syllabus has been drawn up. This may need additions and alterations before it can suit the requirements of various departments and States.

This course will deal with Production Engineering, Workshop Practice, Heavy Earth Moving and Allied Machines, Tube Wells and mechanical design of transmission towers and dam-gates. It will be of three months duration. It is divided in two parts. Part I, on Production Engineering and Workshop Practice starts on 18th October. The trainees will be taken on a tour to visit works and laboratories of distinction in the country for about a fortnight from 22nd November. Part II on Heavy Earth Moving and Allied Machines, Tube Wells and mechanical design of transmission towers and dam gates will commense on 10th December and will and on 14th of January, 1957. preceded by the tour. The tour period is common to both.

The course has been divided in two parts to enable officers, who cannot be spared for full course, to attend only the 1st or the 2nd part.

Syllabus

PART I

Production Engineering And Workshop Practice

I. Production Engineering.

1. Industrial management, production planning, estimating, rate fixing, Jig and Tool design, speeds, feeds and manufacture.

2. Progress control inspection and quality control.
3. Work study : Time and motion study, incentives, job evaluation, labour cost control.
4. Cost accounting.
5. Engineering Materials : Rubber Plastics, fibres, refractories, bearing materials, Testing of Materials : Destructive and non-destructive tests and inspection.
6. Timbers, their properties, structures, treatment, uses and inspection.
7. Modern developments in the production of semi-finished ferrous and other non-ferrous materials and their alloys.

II. Workshop Practice.

1. Engineering economics, selection of site, plant layout, and works organization.
2. Stores organization layout, equipment, care and inspection.
3. Modern developments in the design of automats, their economics, application and settings.
4. Latest developments and practices in ferrous and non-ferrous foundry castings : green casting, steel casting and centrifugal casting.
5. Forging practices, die casting, die design and die making machines.
6. Press and sheet metal works : Press tools, blanking, bending, forming, drawing, operation design and types of dies.
7. Heat treatment principles-Allotropic forms of iron, thermal critical ranges, the iron carbon equilibrium diagram. Heat treating processes :—stress relieving, tempering, case hardening, heat treating furnaces, heat treatment of high speed and other special steels.
8. Latest developments in gas and electric welding. Choice of electrodes, determination of current, cost factors, weld metal and base metal structure, different tests of welded joints, weld inspection, metal spraying and surfacing.
9. Design of welded structures and their specific advantages over rivetted design :—Strength of welded joints, study of stress, distribution, expension, contraction, distortion and residual stresses etc.
10. Jigs, fixtures, special machine tools, special tools, their design and application.
11. Measuring instruments, gauges, limits and fits.
12. Visit to Roorkee Workshop.
13. Symposium on subjects chosen by the trainee officers.
14. Visit to important Works., for about fifteen days.

PART II

Heavy Earth Moving and Allied Machines, Tube Wells and Theory and Mechaniqal Designs of Transmission Towers and Dam Gates

I. Heavy Earth Moving and Allied Machines

1. Different kinds of machines, their utility and purpose such as, Crawler tractor, Pneumatic tyre, tractors, Scrapers, Tournapulls, Dozers, C-Roadster, Tourna dozers, Excavators, shovels, Drag-line, Motor graders, Dumpers, Conveyors, Concrete mixers, Stone Crushers, Rollers, Hoists & Cranes etc.
2. Air compessors. Different machines worked by compressed air in construction of big dams.
3. Deisel and petrol engines :—Description of design and latest developments, and their application to earth moving machines.
4. Maintenance, up-keep, over-haul, daily servicing, and lubrication etc. Operating & maintenance manuals.
5. Layout of main repair workshops and field workshops. Reasons for having two different workshops. Selections of necessary machine tools and repair out-fits for main and field workshops respectively.
6. Layout and organisation of main and field stores, purchase and other precedures :—Advantages and disadvantages of having centralised stores control and general rules governing the store organisation.
7. Use and misuse of construction machinery.
8. Methods and cost of material movement.
9. Project layout and selection of machinery :—The project planning ; general principles governing the selection of earth handling and moving machinery.
10. The place and economy of these machines for the development projects in India with special reference to cheap manual labour available in India i.e. manual labour versus machine work.

Theory & Mechanical Design of Transmission Towers

1. Theory of Structures :—Photoelasticity and its application.
2. Applied Elastomechanics with experimental determination of stresses and design factors.
3. Space frames: Application to Transmission Towers.
4. Castiglianos Theorem. Deflection of frames.
5. Mech. principles of the design of overhead transmission system. Design of supports, cross arms and towers, for low and high voltages.

Theory & Design of Dam Gates

1. High head, Gates and valves.
2. Low head, gates for barrages.
3. Spill way crest gates, radial gates, drum gates, slide gates.
4. Symposium on subjects chosen by the trainee officers.

II. Tube Wells

1. Introduction, their importance and their place in irrigation. Ground water divisions, water table.
2. Types of sub-soil formations, Porosity, effective sizes, permeability, size and shape of particles of sand and their importance in location of tube-wells.
3. Hydraulics of wells and prospecting.
4. Types of tube-wells and their design.
5. Construction and development of Tube-Wells. Different methods and machinery. Their advantages and disadvantages.
6. Maintenance of Tube-Wells. Maintenance workshop and stores. Failures and remedies of tube-wells.
7. Design and selection of pumping equipment.
8. Distribution of water in tubewells, lift irrigation by river pumping.
9. Distribution of power for tubewells.
   Electric motors and starters, their characteristics and repairs.
10. Tube-Well specifications. Agreements and projects.

Indo-Pakistan Talks on Indus Basin Waters

The Indo-Pakistani talks on canal waters are approaching a decisive stage. This is suggested by the return to Delhi today of Mr. N. D. Gulhati, leader of the Indian delegation in Washington. Urgent consultations have become necessary to bring the long-drawn-out negotiations to a fruitful close.

Pakistan, it is stated, must now decide finally on the World Bank proposal, which India has accepted and Pakistan, so far, has not.

During the past 17 months, the delegations of both countries have been engaged in the preparation of comprehensive plans for use of the waters of the Indus system of rivers. Both sides appear to have proceeded separately and thus the two plans prepared show a wide divergence in costs.

In the meantime, a wholly mistaken impression has been created by recent messages from Pakistan which refer to a Rs. 1,000-crore "Master Plan", stated to have been evolved by the World Bank in consultation with the Pakistani engineers.

The figure of Rs. 1,000 crores has come as a surprise to India. That the World Bank, under whose aegis the current negotiations are proceeding, should in any way be associated with it is considered unlikely.

Such a plan, if one exists, could only relate, as the name implies, to an overall irrigation development plan, encompassing all the potential schemes to be undertaken by Pakistan during the next few decades.

The Indo-Pakistani dispute, on the other hand, relates to the feasibility of finding alternative sources for the waters of the Sultej, Beas and Ravi, allotted to India. To promote an agreed solution, India has accepted the Bank's recommendation that the cost of the link canals which Pakistan will have to construct to replace the flow waters of the Indian rivers will be borne by India.

Therefore, it is clear that India's financial interest in Pakistan's "Master Plan" is limited, being confined to replacement costs. The Bank proposal says : "It is proposed that the costs of these works will be borne by the two countries in proportion to the benefits. Thus, the cost of a canal in Pakistan of the capacity required to replace supplies from India would be borne by India ; but if Pakistan decides, in its own interests, to increase the capacity beyond what is needed for such replacement, the cost would be shared proportionately by the two countries."

Any suggestion that India could finance Pakistan's additional irrigation programme would appear to be based on a misconception. India, it seems, is unlikely to support a much bigger claim than Rs. 60 crores, which, in the opinion of Indian engineers, should suffice to meet the replacement costs.—June 11, Statesman.

Pakistan considers World Bank Proposals

West Pakistan irrigation experts met here this morning to formulate proposals to equip West Pakistan with alternative sources of water supply in the light of the report submitted by the Pakistan delegation to the talks on Indo-Pakistani canal waters dispute held in Washington under the auspices of the World Bank.

The conference also considered the World Bank's latest communication on the subject.

The Pakistani report prepared, in collaboration with World Bank experts, is understood to envisage a plan to make West Pakistan self-sufficient in her irrigation requirements. The plan, if implemented, will cost Rs. 1,000 crores on the building of dams and reservoirs to store flood waters of the Indus and the Jhelum. It also suggests construction of link channels between the Indus and the Sutlej and the Ravi to feed the Sutlej and Ravi canals when required.

Pirzada Abdus Sattar, West Pakistan Law Minister, is meeting the experts tomorrow to give final shape to their recommendations. These will be discussed by the West Pakistan Cabinet on Wednesday. Its views will be forwarded to Karachi.—June 11, Lahore.

West Pakistan Cabinet Recommendations

The West Pakistan Cabinet this evening finalised its recommendations on the Indo-Pakistan Canal Water Dispute with particular reference to the latest World Bank proposals on the issue.

Today's Cabinet meeting lasting five and a half hours was the last of the series held during the last week to discuss the question under the chairmanship of the Governor, Mr. M. A. Gurmani.

A spokesman of the Cabinet said after the meeting that West Pakistan Government's recommendations on the dispute were being conveyed to the Central Government.

He declined to disclose the stand taken by the Government on the issue or the policy formulated by it.

Press reports given wide publicity here had said that the World Bank proposals envisaged a rupees one thousand crores master plan designed to make West Pakistan independent of the three Eastern Indus basin rivers falling in Indian territory by constructing dams, reservoirs and link channels.—June, 13, Lahore.

Questions in the Indian Parliament

India had not actually agreed to the World Bank's latest plan to settle the Indus waters dispute between India and Pakistan but had suggested in her reply to the Bank's aide-memoire, that if any co-operative work was to proceed, it should be done on the basis

(*Continued on page* 22)

Book Review

Fifth International Congress on Large Dams, special supplement to "Travaux", Editions, Science et Industrie, 6 avenue Pierre ler De Serbia, Paris 16e, France, 316 pages, $12\frac{1}{4}'' \times 9\frac{1}{2}''$, paper cover, 2650 French Francs

This large and handsomely produced book is a review of the hydro-electric developments in France and French overseas territories and represents a salient cross section of the design and construction of large dams and appertenant works.

The first section covers the work of "Electricite de France", and forms nearly one third of the text. Here are found articles on the evolution of construction equipment used for large dams ; the manner of selection of sites ; the hydel works on the river Rhine between Basle and Strasbourg ; the construction of the Tignes Dam, 160 m high, and having a storage capacity of 230 million c.m ; the dams of the Savoy region ; the Durance project ; covering the Serre-Poncon dam—its site survey, choice of the type of structure and the technical features of the work ; and developments in the Upper Loire, River Dordonge, and on the Trayers and the Maronne. The last article in this section covers the Gave-De-Pau developments describing in particular the Cap-de-Long dam.

The second and the third sections cover projects on the Rhone river, viz the hydro electric development of the river Rhone and the falls of the Genissiat and Donzere-Mondragon, and the Montelimar falls ; the reservoir dam of Chantonnay and the Malpasset dam. The latter has been designed as an arch dam in concrete with a single arch. The entire structure is formed from a thin arch with radii which vary with the height both on the upstream and downstream sides, which allows at the cost of a slight complication in shuttering, a better utilisation of material. Before proceeding on to foreign hydel works, a set of three articles outline the facilities for hydraulic research and describe the Chatou National Hydraulic Laboratory, the Central French Hydraulic Laboratory, and the role of scale model studies for hydraulic problems and turbine tests in such labs. as the Ets. Neyrpic, which has attained world wide fame, and Laboratoire Dauphinois d'Hydraulique begun in 1906 and since affiliated to Neyrpic, containing some of the remarkable equipment for turbine testing. As may be aware, the Neyrpic laboratories have been consulted by many bodies for model tests, including India, where the model of the Bhakra dam can be found alongside the models of the Delcommune in Belgian Congo and the Wildegg-Brugg in Switzerland. The giant laboratory, which is the largest in Europe and one of the largest in the world, occupies an area of 6 hecta acres and employs over 400 engineers and technicians.

The two last sections cover French hydroelectric works in North Africa, such as in Algeria, Morocco, and Tunisia ; and other overseas territories, like French Guinea, Cameroons, Lagone Tchad, French Equatorial Africa, Madagascar and New Caledonia.

All the articles are written by engineers specialising in their own sphere of activity and intimately connected with the work they describe. The lucid photographs and illustrations add immeasurably to the value of this fine publication, and enable the outside world to gauge the emminence and worth of French technologists in the fields of hydro-electric water power development. A work of this type should be brought out from this country which has now built some of the most remarkable hydel structures but whose publicity is very limited to the outisde world.

S. K. GHASWALA

Der Dammbau, *by* Dr. Ing Karl Keil, Springer Verlag, Reichpeitachufer 20, Berlin W, 35, Germany, 597 pages, DM 69.00

The book is written by a leading engineer of Germany, who also holds the chair of Engineering Geology and Geotechnique in the Dresden School of Technology. It is a comprehensive publication on the construction and engineering geology of earth dams, highway and other embankments and dikes. It is not a treatise on the design of such structures but a work of reference on the actual construction aspects

The subject is bisected into two sections, viz, general principles and geotechnique data. The first covers five chapters and deals with such topics as general characteristics of filling for embankments, masonry dams, and bridges ; foundation problems ; typical properties of materials of dam construction, with examples of structures built in the United States and in Germany ; and physical characteristics of soils covering porosity, granulometry, permeability, capillarity, etc. The mode of transport of large quantities of materials for construction of such dams is also covered here.

The second part comprising seven chapters takes the readers into the field of engineering geology and geotechnique and discusses the various equipment used in large hydel works ; quality control of materials, problems in settlement and safety measures ; and construction of dykes.

The text is littered with clear illustrations and photographs, and has a fairly well balanced bibliography of 500 items of both English and European sources.

It is altogether an excellent text on the practical side of construction of dams, embankments and allied structures with special reference to methods in engineering geology.

(*Continued on page* 22)

Editorial

Rivers and Politics

The Aswan Dam project on the Nile made headlines recently when the United States and Great Britain announced their decision withdrawing their offer to participate in the financing of the Project. The magnitude of the project is breath-taking : It would generate 9,000 million KW of electricity in addition to irrigating 2 million acres of Egyptian land. The project was estimated to cost $ 1,300 million. The hydrological background of the Nile was described in an article published in a recent issue of this journal (June, 1956). As is welknown, the river courses through several States, Uganda, Ethiopia, Sudan and Egypt, and has a history of previous inter-state agreements and arrangements. It is noteworthy that of the two reasons given by the State Department of the United States Government for their decision, one is "*failure of the States of the Nile to reach an agreement on the division of the river waters.*" International politics of the highest level may also be one of the conditioning factors. But it would be wrong and unwise to minimise the importance of the cause quoted above. It is difficult to discuss the merit of the question without all the necessary relevant technical details of the project and the viewpoints of the participant States. But there is nodoubt that the postponement of the development of the Nile waters would mean such a great setback to Egypt's and Sudan's peoples. Withdrawal of USA and U.K. may or may not be followed by a promise by the USSR to finance, but the major Gordion knot will still have to be untied.

Do we learn any lesson from this experience ? We should, if we have not already done so from our own experience. India and Pakistan are neighbours. Many rivers pass through both of them. The Indus Basin system has remained a point at issue for long enough time and as yet not much progress seems to have been arrived at inspite of the good offices of the World Bank. Here the rational attitude would have been for a joint development of the entire system. But when brothers have been partitioning a joint family of centuries, rationality has only an instrumental value of expressing their deep-rooted emotions and historical attitudes. Even so, years of patient negotiation has not been able even to "divide" the rivers between themselves on an agreed basis !

Meanwhile newer problems and issues are maturing for public controversy. The Ganga Barrage Project, it is learnt, is being objected to by Pakistan for it needs the fresh river waters to flush the Pakistan portion of the Ganges delta or for other necessary purposes. How long will this issue take to settle down God alone knows, for queer is the way of traditional politics. We have published several contributions in the past regarding this project showing how it is one of the most life-giving schemes to West Bengal in general and to the port of Calcutta in particular.

The successive and almost routine annual floods in India and Pakistan have heightened our consciousness for cooperation between bordering States, and already arrangements for meteorological and hydrological observations and transmission of information have been arrived at between India, Nepal, Pakistan, Bhutan, China, Sikkim, etc. Thus Nature's calamity has been the basic compelling force for promoting human cooperation, in howsoever limited a scale. India and Pakistan are soon to have talks on ministerial level on the issue of cooperation in regard to flood control. But is it not time that the myopic mentality bedevilling the relationship between the two countries be atleast attempted to be given up in regard to the approach to river resource development on a larger canvas ?

Take, for example, some of the rivers originating in India whose floods ravage East Pakistan. They could be harnessed for both flood control as well as hydroelectricity which would benefit Pakistan tremendously, but the sites for such projects would naturally lie within the Indian borders. Then again, the entire eastern region covering W Bengal, East Pakistan, Sikkim, Bhutan and Assam needs to be tackled as one single natural region in order that floods be prevented, large scale afforestation and soil conservation practices introduced to reduce soil-erosion and siltation, inland river navigation developed, power generated. How can such vistas of development may even be imagined as practical possibilities unless the barriers of man-made boundaries are first emotionally removed? Adjustments, compromises can always be arrived at where there is the will to cooperate. What is needed is not just passive, non-quarelling neighbourliness of nation-states, but active, imaginative and intelligent cooperation between peoples informed by a philosophy of enlightened self-interest.

The politics of nationalism inevitably trends to-autarky and self-sufficiency. A region ravaged by colonialism for nearly two centuries is more emotionally nationalistic than possibly it would otherwise had been. Therefore the nationalistic attitude, implying a degree of distrust of one's neighbours, prevalent in the newly-freed countries is understandable. But one cannot build on stable foundations with such a frame of mind ; for an attitude of distrustful and defensive self-sufficiency is itself

(*Continued on page* 24)

(*Continued from page* 20)

Book Review

Schleusen Und Hebewerke, *by* Dr. Ing, Hans Dehnert, Springer Verlag, Reichpietschufer 20, Berlin W, Germany, 348 pages, DM, 45

This is a highly specialised treatise on the planning, design, construction and operation of ship locks on canals and rivers. A historical introduction on the subject reveals that such locks existed in Europe as far back as 1398, and the author after describing these early structures gives a chronological data from the early 14th century to 1950.

Detailed design and calculations are given and discussed mostly for European canal systems such as those on the Mosel, Lahn, Ruhr, Saale, Elbe and others. The complicated machinery of the locking arrangements are detailed with clear illustrations and photographs of existing structures, which add considerably to the worth of this treatise. In describing these locks, several unusual types of structures are also mentioned such as those in which both water and ship are lifted and lowered.

An excellent bibiliography of references, subject-wise, is appended at the end. If this excellent treatise is to have a wide readership it is imperative to have it translated in the English language.

S. K. Ghaswala

(*Continued from page* 19)

Indo-Pakistan Talks on Indus Basin Waters

of proposals made in 1954, Mr Jaisukhlal Hathi, Deputy Minister for Irrigation and Power, told Mr. S. N. Das.

Mr Hathi refused to disclose the features of the new scheme outlined in the Bank's aide-memoire saying that this could be done only by agreement amongst all parties concerned.

Dr Gidwani : Is it a fact that the scheme was prepared by the Bank in consultation with the Pakistant Government.

Mr Hathi : The scheme was not prepared actually in consultation with the Pakistan Government. It had prepared a comprehensive plan and both Governments tried to see whether they could agree on this. It could not be done. The Bank had thereupon prepared an aide-memoire on the basis of the various data it had collected.

Mr Murthy : Are the Bank's proposals in the nature of an award ?

Mr Hathi : We are using the good offices of the Work Bank and it depends upon the two countries whether they accept its proposals or not. Naturally the views of an institution like the World Bank would be duly considered by both Governments.

(*Continued from page* 6)

Planning India's Irrigaton Development

The general picture of the basin-wise and region-wise potential will serve as a reasonable guide for selecting schemes for detailed investigation and execution in course of time.

Investigation & Survey

Investigations and surveys are divided, according to their objective, into three general classes :—Reconnaissance survey, Preliminary investigations and Detailed investigations.

Reconnaissance Survey

This consists of a study of the project area with the help of the Survey of India topographical maps followed by a visit to the area for a general impression of its topography and to collect as much local information as possible regarding the climatic conditions including rainfall, existing crops and irrigation practice, land values and water rates, subsoil water levels and quality of water, man-power and cattle wealth mineral resources and construction materials, soil conditions, etc. In the case of a storage project, the various possible dam sites, nature of rock and general information about depth of foundation at these sites would also be collected to determine possible sites for dams. Rough cost and benefit estimates could thus be prepared to justify further investigations.

Preliminary Investigations

If the results of the reconnaissance survey are promising, preliminary field investigations are conducted to verify the local information as collected. These investigations will include, if not available with the Survey of India, contour surveys, geological surveys and the construction materials surveys. These surveys help determine the most suitable of the possible dam sites, of canal alignment, the commanded area, etc. A fair picture of the project would thus be available.

Details Investigations

Having determined the feasibility of the project by preliminary investigations, detailed investigations are taken up. As a result of these investigations the engineer should have all the relevant data to proceed with the designs and specifications of the structures and be able to arrive at a reasonable accurate cost estimate of the proposed project.

Notes & News

Funds and Experts needed to develop Water Resources

Technicians and funds are needed if the water resources of the world are to be developed to meet the demand of growing populations and industrial progress, according to a report submitted by the Secretary-General of the United Nations to the Economic and Social Council.

The report which reviews the activities of the United Nations and its specialized agencies in this field during the past two years, follows in interim report made to the Council which pointed out that "in many areas the supply of water is proving inadequate to meet the growing demand" and stressed that "the tendency of water requirement is to increase faster than the population" and that "the increasingly serious shortage of water is a deterrent to economic growth."

Action Necessary

The interim report singled out three areas in which it was felt early international action should be taken :—

—the gathering, and analysis of hydrological data,

—the extension of knowledge of the techniques of watershed management,

—the necessity for considering industrial needs in overall water planning.

The Council asked the Secretary-General to strengthen international technical co-operation, to consult with governments and organisations on the matter and to report back to the Council not later than 1956.

Responsibilities of Agencies

Describing measures already taken, the report outlines the areas of responsibility assumed by the various agencies concerned with water questions. The UN World Meteorological Organisation (WMO) has undertaken to promote the collection, analysis and exchange of hydrological data and has established a Panel of Experts on Water Resources Development. The UN Food and Agriculture Organisation (FAO) has the primary responsibility for the study of watershed management in all its aspects including its relation to erosion control, upstream water management and the use of farm and forest range land and the UN Educational, Scientific and Cultural Organisation (UNESCO) is co-operating in the publication of a hand book which includes a broad educational programme related to watershed management.

Efforts have been made in a variety of fields by the UN Economic Commission for Asia and the Far East (ECAFE), the UN Economic Commission for Europe (ECE) and by the UN Economic Commission Latin America (ECLA), continues the report.

Pilot Project

ECAFE has taken a prominent part in the study of international rivers in the region, one of the pilot projects being a survey of the lower Mekong River basin covering parts of Cambodia, Laos, Thailand and Vietnam and subsequent exchange of information between the governments.

A training integrated centre for water resource development has also been set up in this area at Roorkee University, India, under the joint sponsorship of ECAFE, UN Technical Assistance Administration and the United States Mission. This centre is open to trainees from Asia and Africa.

* * *

WMO Bulletin on Thunderstorms

Thunderstorms are the subject of a Bulletin issued by the United Nations World Meteorological Organisation (WMO) to aid meteorologists, farmers, civil engineers, biologists and those engaged in public transport.

The data, collected over a period of three years through thunder and lightning observations on land and at sea, published with a series of 17 world maps giving the average thunderstorm days for each month, for the quarters and for the whole year. These maps are being issued at the same time as the Bulletin.

Climatological Atlas

In the broader field of map-making, WMO has been considering the production of a climatological atlas of the world. At the last WMO congress in May 1955 a working group was set up to study the questions involved. According to the group, the projected WMO work should lead to coverage of the world in a series of loose-leaf sheets based upon national, sub-regional and regional maps which would summarise the climate of the different regions.

The group also recommended that the WMO member states be urged to prepare national maps.

Two additional countries have recently become members of WMO. They are Cambodia and Libya.

* * *

Timber Poles for Transmission of Electricity

The extent to which India's rural electrification schemes under the second Plan depend upon a well-planned policy of afforestation and forest management became apparent during the plenary meeting of the Standing Committee of the Central Board of Forestry, which concluded its five-day session at Srinagar rcently.

For a phased programme of electric supply to 10,000 villages, involving nearly 25,000 miles of transmission lines, about 850,000 poles would be required during

the Plan period. A correspondingly large quantity of crossarms, bracings, pins, etc. would also be needed. According to experts, the use of wood instead of steel for transmission poles is likely to reduce capital costs by Rs. 1.5 crores and the demand for steel by 45,000 tons.

As directed by the Standing Committee, a technical sub-committee, consisting of all the forest officers present, representatives of the Central Water and Power Commission, the Directorate-General of Supplies and Disposals, the Planning Commission and the Railway Board, had earlier examined the question.

The technical committee agreed that State Governments should take as a long-term plan, suitable aforestation measures for the supply of full-length poles.

* * *

Introducing Powerlooms in Handloom Sector

The Government of India have requested State Governments to draw up schemes for the introduction of powerlooms in the handloom sector on lines indicated by them.

It was announced recently that 35,000 powerlooms would be installed over 2 years i.e. 1956-57 and 1957-58 to assist the existing handloom weavers working on a co-operative basis to switch over to a more economic method of production.

Out of the additional production of 1,700 million yards of cloth required during the second Plan, 200 million yards are to be obtained by the introduction of powerloom in the handloom sector.

In a letter addressed to State Governments, the Centre has said that the existing handloom co-operative societies would be assisted to changeover to powerlooms. Other powerloom co-operative societies may also be formed of existing individual handloom weavers. The Centre has also indicated that it is not necessary to insist that where a powerloom is put in commission, a handloom should go out of commission.

The Centre will give financial assistance to meet the cost of the powerlooms, for the share capital and working capital of the weaver members of co-operative societies and the capital expenditure for preparatory and processing plants and for workshops. The Governments have also been asked to recruit a few persons to be trained in installing powerlooms and in weaving cloth so that they can serve as instructors to powerloom weavers.

* * *

Dr. K. L. Rao

Dr. K. L. Rao who has been appointed Member (Designs & Research), Central Water and Power Commission, Government of India, took his Engineering Degree with Honours in 1927 from the Engineering College, Madras. Later on got the Research Degree, M.Sc., of the same University and took his Doctorate in Engineering from the Birmingham University, United Kingdom.

Dr. Rao worked as Assistant Professor and Senior Lecturer in various Engineering Colleges in Rangoon, Madras, and Loughborough, Leicestershire, U.K. Dr. Rao is the first Indian to hold a research scholarship and later senior lecturership in any Engineering Institution in United Kingdom.

He worked in the Cauvery Mettur Project during early stages and later worked in England under Mr. Leslie Turner and Chief Engineer, Reynolds. He is Member of the Society of the Institution Engineers (London) and Institution of Engineers (India).

He was awarded Governor-General's Prize for the best paper of the year by the Institution of Engineers (India) for contributing "Engineering Difficulties in Ramapadasagar Project".

Dr. Rao has visited various dams in Europe, Egypt, England, America, China, etc., and has himself designed a number of dams in India like Lower Bhawani, Tungabhadra, Malampuzha and is now engaged on the design of Umtru and Kosi.

He worked as Director (dams) and later as Chief Engineer, Flood, Planning & Designs and is now working as Member (Designs & Research), C.W. & P.C., Government of India.

Dr. Rao is Chairman of Civil Section of the Institution of Engineers (India).

(*Continued from page* 21)

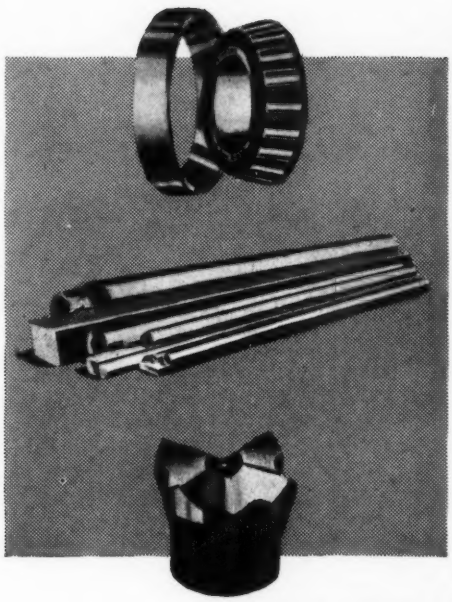
Rivers and Politics

unstable in character. Industry and agriculture may possibly be built on such premises for a time. But there are other compelling factors which necessitate cooperation and interdependence between neighbours. Large inter-State rivers provide one such factor. No integrated national development of either India or Pakistan is possible without accepting the natural discipline imposed by these rivers. On the other hand, with a rational, integrated and *basinwise* development of these large river systems as the Indus, the Ganges, the Brahamaputra will emerge a new relationship of interdependence, cooperation and cohesion culminating into friendship between adjacent countries. It is this new force which will undermine the foundations of antarky and distrust and in course of time will generate a new pattern of inter-State relationship as yet beyond the ken of our presentday politicians. This is certainly idealism, but not day dreaming. Even today such relations have grown between USA and Canada, USA and Mexico. The European Rivers, the Danube and the Rhine, are already instances of such inter-State cooperation. In fact more and more the entire Europe is today being conceived, integrated and developed as a single unit of natural resource base irrespective and inspite of political boundaries.

The politics of great rivers is by its very nature the politics of cooperation and of active regional development ; it may be in partial conflict with the prevalent notions of politics. In that case, we must be discriminating enough and must try to own the attitudes that would be in consouacne with our need to face the problems of increasing population by rapid resource development and thus assure to posterity a future of prosperity and contentment.

TIMKEN

Trade-Mark
Owned and Registered
By The Timken
Roller Bearing Company
Canton, Ohio, U. S. A.



"TIMKEN," the world-famous trade-mark owned and registered by The Timken Roller Bearing Company, Canton, Ohio, U.S.A., identifies the products of one of the world's leading precision engineering-manufacturing organizations.

TIMKEN Tapered Roller Bearings . . . TIMKEN Fine Alloy Steels . . . TIMKEN Graphitic Tool Steels . . . TIMKEN Seamless Steel Tubing . . . TIMKEN Rock Bits — all are specific products of The Timken Roller Bearing Company. "TIMKEN" is the trade-mark that distinguishes these particular products from all other similar products.

The trade-mark "TIMKEN" assures users of the highest quality standards when buying tapered roller bearings, alloy steel or removable rock bits.

British Timken Ltd., Birmingham, England and Société Anonyme Française Timken, Asnières, France, are registered users of the TIMKEN trade-mark.

World-Wide Availability

TIMKEN *Made in* **U.S.A.**

TRADE-MARK OWNED AND REGISTERED BY
THE TIMKEN ROLLER BEARING COMPANY

TAPERED ROLLER BEARINGS

Distributor of Timken Made in U.S.A. Tapered Roller Bearings

VOLTAS LTD.

Chinchpokli Road, Bombay 12, India

T.876

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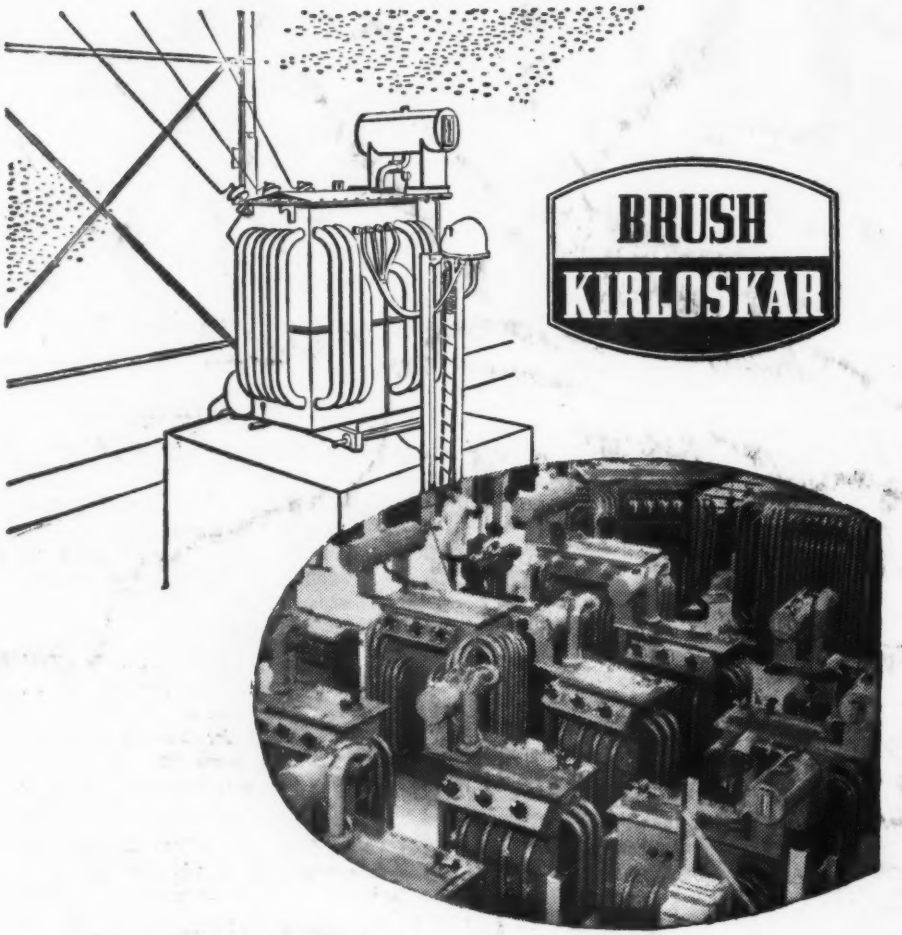

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